Editorial

WHY is it that the Australian research worker and engineer is such a modest fellow? Why is it so hard to get him to talk about what he is doing, or to persuade him to let others speak for him?

At the moment, there are literally dozens of highly valuable and often original projects being carried on by bodies such as the CSIR and the PMG Research Laboratory about which no-one ever hears a whisper.

More than once, I have tried to break through this wholly uncommendable modesty, and to tell Australians what their countrymen are doing. The result, or lack of it, has forced me to the conclusion that these and similar bodies are anxious to discourage such publicity, rather than to foster it.

Our American friends have often been the subject of good-natured and sometimes rather contemptuous smiles because they believe in telling the world about their doings. I am not suggesting that we should duplicate their efforts, or even the manner in which they are carried out. But I do seriously suggest it is time we realised that too much modesty, or reticence, or indifference, can be a harmful thing.

I often glance through the pages of journals from all over the world, reading of what their brains and workmanship are producing knowing full well that we have here projects just as fine, and often more highly developed.

Only recently an engineer spoke to me about a paragraph in our last issue concerning some new communications equipment. He told me that similar equipment was about to be installed here in NSW and may even now be in operation. It was news to me, because no one had thought it worthwhile to publicise it.

There have, unfortunately, been instances in which the daily press has obtained or been given technical details about such things, and have very understandably misinterpreted the story through lack of familiarity with the subject. It may be that these instances have had something to do with reluctance to repeat the process.

But there are journals such as our own which are quite capable of accurately interpreting complex subjects for the information of the scientifically inclined layman. Some of our staffs have actually worked on similar projects during the war.

For heaven's sake, then, let us give up this strange idea that what we do isn't worth talking about. Our research executives have everything to gain by telling as much of the story as they can.

John Moyle

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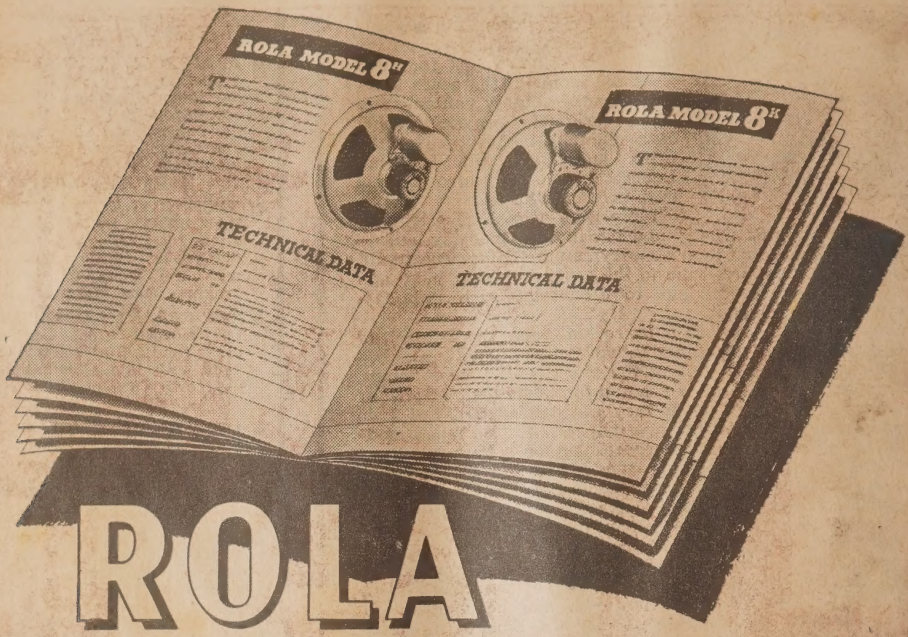
ITOR: JOHN MOYLE, M.I.R.E. (VK2JU). TECHNICAL EDITOR: NEVILLE WILLIAMS, A.M.I.R.E. (VK2XV).

JUST OFF THE PRESS!



ROLA

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CONTENTS INCLUDE

- Full details of the complete range of Rola loudspeakers, transformers and filter chokes.
- Power ratings, cone resonance and mounting dimensions of each type.
- A power voltage and impedance calculation for sound engineers.
- Information on two new 12 inch type Rola loudspeakers.
- A story of modern loudspeaker magnets.
- Impedance ratings and type codes of Rola line-to-voice-coil transformers.
- Rola loudspeaker magnet classification table.
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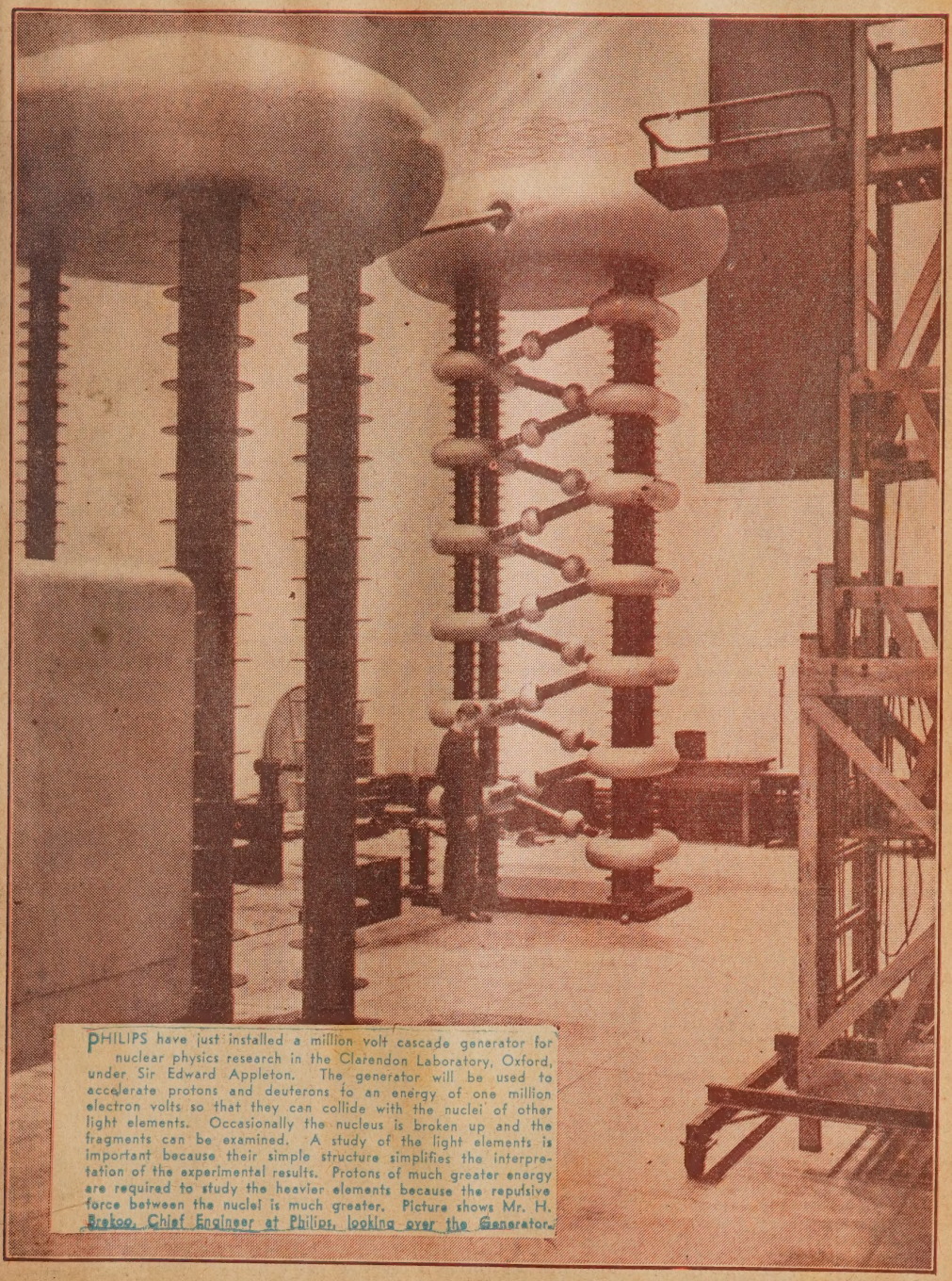
MILLION VOLT RESEARCH GENERATOR



PHILIPS have just installed a million volt cascade generator for nuclear physics research in the Clarendon Laboratory, Oxford, under Sir Edward Appleton. The generator will be used to accelerate protons and deuterons to an energy of one million electron volts so that they can collide with the nuclei of other light elements. Occasionally the nucleus is broken up and the fragments can be examined. A study of the light elements is important because their simple structure simplifies the interpretation of the experimental results. Protons of much greater energy are required to study the heavier elements because the repulsive force between the nuclei is much greater. Picture shows Mr. H. Brakoo, Chief Engineer at Philips, looking over the Generator.

HOW FAST CAN MAN EXPECT TO FLY?

Facing a gale of 350 mph this man's face is distorted—ears stretched out of shape. Inset shows man's normal appearance.

Aircraft are now being made which can achieve supersonic speeds. But what of the men who fly them? They, too, must be able to withstand the strain of such flight. Ceaseless experiment is being carried out to ensure their safety.

PROBLEMS of flight, from the pilot's point of view, include how to keep him from being roasted, due to air friction with the fuselage which can heat up to 250 degrees F., how to avoid the terrific battering he may receive from air turbulence at supersonic speed, and how to prevent him from blacking-out when he attempts to turn his aircraft when travelling faster than sound.

In case of accident he must be able to leave the machine in one piece, without being literally torn to pieces by air-pressure in the process.

All these difficulties can be avoided, but it means much painstaking research in which human guinea pigs face great discomfort and possible death in the process.

"Blacking-out" is caused by centrifugal force, which, in today's record-breaking planes, can reach 18 times the pull of gravity, a unit known as "G." This is far more than a man can stand. About nine G's will cause a blackout — more than this may actually rupture internal organs and cause serious injury and death. Even seven G's is more than can be tolerated in actual flight. At this figure, blood vessels in the eyes will rupture, although apparently there is no danger of cerebral haemorrhage, as might be expected.

Special air suits which prevent sudden movement of blood, particularly from the brain, have added an extra margin to tolerance figures, but extreme values will probably mean that the pilot must lie prone to equalise blood pressure as much as possible.

BLACKOUT TESTS

Special apparatus in which pilots are whirled round in a device reminiscent of Lunar Park, allow exact records to be made of blackouts. They show that in a prone position, up to 40 G's can be endured, although for a few seconds only, and in exceptional cases.

Artificially-cooled cockpits and flying-suits ventilated from the outside air are being examined in an attempt to overcome air-friction heat. Important point here is that the remedy must not unduly inconvenience the pilot, and shorten his flying-time through lowered efficiency and fatigue.

This latter is particularly important because, at high speeds, there is so little time to think. The pilot must act quickly when travelling at more than 12 miles a minute — the speed of sound. His bewildering array of instruments and controls must be handled with complete precision and confidence if he is to avoid a crackup. His reaction speed must be better than normal, and be in working order all the time.

HIGH LEVEL SOUND

The effects of high intensity sound above the audible limit is another point which requires careful study. High-speed jet engines are excellent generators of such sound, apart from the pressure waves set up by the aircraft itself. Although these sounds cannot be heard, they have a pronounced effect on the nervous system, causing great nervous and emotional stress, confusion, and lack of co-ordination — just the qualities the high-speed flier must possess all the time. Only experiments with courageous volunteers under test conditions can give the answers as to how much sound a man can stand.

Getting the pilot safely out of a high-speed aircraft in an emergency is quite a problem. To be suddenly exposed to high air pressure is to risk almost certain injury from sheer impact. As the aircraft will probably be flying at a great height, the pilot must be protected from freezing to death before he has fallen into more temperate air. And he must also be protected against possible death from oxygen starvation until he has descended to a safe altitude.

A height of 30,000ft. will cause death without oxygen, and at 63,000ft. a man's blood literally boils with the reduced pressure.

One modern approach is to provide for the entire cockpit to be detached from the nose and tail when a bailout is required, the whole centre-section being parachuted to earth. When he has reached a safe height, the pilot can bail out of his seat in the normal way with a parachute.

Another possibility is to provide him with a protective suit, and a seat which is literally shot earthwards to pass him quickly through the danger zone

It is obvious that the problem of supersonic flight at high altitudes does not end, therefore, with the production of the plane. Not only the pilot, but the passengers, if any, must be protected against the great dangers associated with a sudden projection into the ionosphere when trouble appears. Until this is successfully achieved, we cannot keep pace with our design engineers.

AIR PRESSURE SPEAKER HAS BIG VOICE

THE loudest loud-speaker ever built works the same way your voice does—but it makes more noise than a champion hog caller locked in a telephone booth.

The Dilks Vocal-Aire loud-speaker, now being manufactured by two young engineers in a small factory in the little town of Seymour, Conn., talks by modulating a moving stream of air, just as your larynx modulates currents of air from your lungs. The secret of their unit is two carefully machined grids, one stationary and the other mobile, counterparts of the human vocal cords. A motor-driven compressor drives air through the slots in the grids, while the mobile grid is made to vibrate by audio impulses from an amplifier

This sets the entire column of air directly into sympathetic vibration, and the result is a sound that can be heard 10 miles away.

RADIO SPEAKER

In your home radio or phonograph the voice coil of the loud-speaker vibrates the cone — really just a special shape of the diaphragm in old-fashioned earphones. The cone in turn, sets the surrounding air into sympathetic vibration. But where high sound intensity is required the cone-type speaker is not very efficient; in the triple-play conversion of electrical audio impulses into sound waves that you can hear, a lot of energy is lost.

Because its vocal cords vibrate the air directly, a Dilks unit with a 20-watt amplifier can produce sounds many times louder than those from an ordinary speaker using the same amount of power.

The slots are 006-inch wide and are spaced 015-inch apart. The touching surfaces of the grids are ground and lapped to a high degree of flatness, so that when the reeds of one are mounted over the slots of the other a perfect air seal results.

The free end of the mobile grid carries a steel armature, which floats between the poles of a magnet that makes the grid vibrate when audio pulses flow through the voice coil. Here, again, close tolerance is necessary; the armature must clear the lower pole piece by .001-inch and the upper one by 006. Thus, when the speaker is operating, the mobile grid will float free in its vibrating range of 002-inch without hitting either pole pieces or stationary grid. If it did hit, the resulting "chatter" would destroy tone quality and intelligibility.

Their big research problem—which, for lack of rules to go by, they must attack by cut-and-try—is to get higher fidelity. At present their speaker doesn't respond to very low tones. Its frequency range of from 250 or 500 cycles up to 5000, depending on the size of the horn, compares unfavorably with the 50 to 8000 cycles in high-fidelity radios

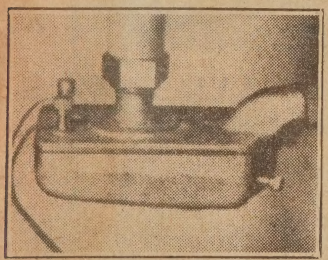
This gives the Dilks unit a deep enough base for human speech, but its makers do not recommend it at present for high-quality musical reproduction.

The problem of distortion was solved by special design of the grids referred to above.

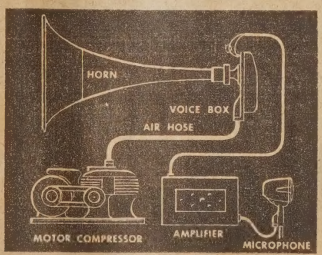
Tolerances are fine, calling for 40 slots in the stationary grid and 39 in the mobile grid.

Essential parts are a power motor to provide the air blast for the speaker assembly. Leads from the unit are connected to the amplifier, output from which controls the air blast by vibrating the special grids.

The use of air pressure high powered speakers has been the subject of research for many years, but so far many essential difficulties have been hard to overcome. Popular Science gives these details of a version which seems to foreshadow important developments in this new field.



Assembled voice unit has connection at left from the amplifier to the voice coil; coupling at right is for the air hose from the compressor. At its top is the stem of the loudspeaker's horn.



How it works: Audio pulses from mike, relayed by amplifier, vibrate grid in voice box. Vibrations are transmitted to the stream of air from compressor and go out through horn as sound.

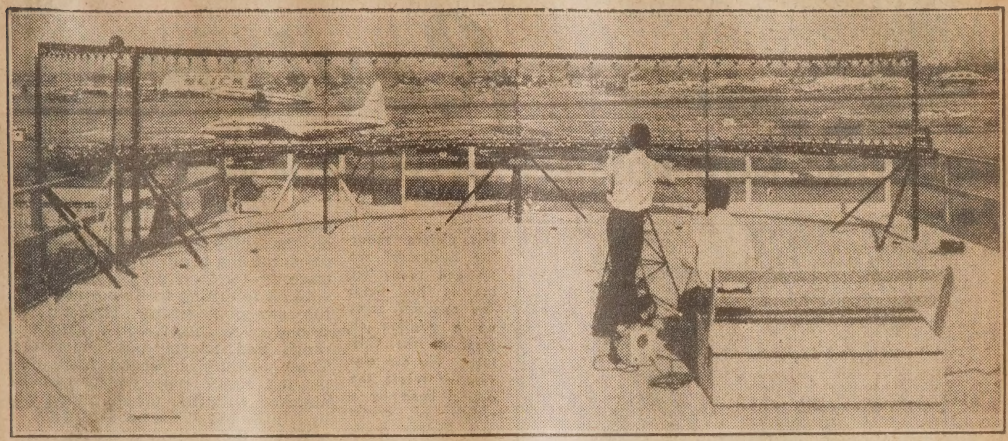
GAS TURBINE TOPS 1000 HOURS ON TEST

EXPERIMENTAL 2000 hp land gas turbine, announced over a year ago by Westinghouse Electric Corp., has proved out on test runs totalling over 1000 hours. Operation under all types of loading and up to design temperature of 1350 degrees F. has caused no objectionable distortion and no serious creepage.

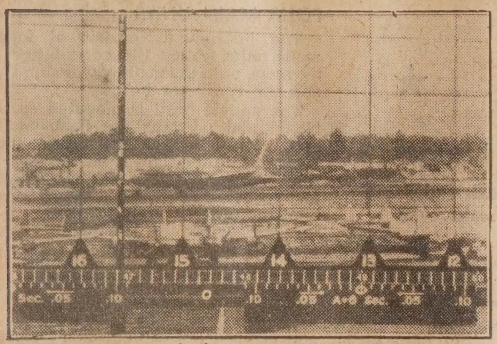
Over-all fuel rate at full load of 0.78 lb per bhp-hr. corresponds to a thermal efficiency of 16.7 per cent. Maximum output developed was 2220 hp. Turbine efficiency varied from 84-86 per cent over the operating range.

Operating experience is encouraging. The turbine is easy to start and control, runs smoothly, and is not excessively noisy. No distress has appeared in any heated parts. Tests show clearly that a simple open-cycle gas-turbine power plant having a fuel rate of 0.6lb per bhp-hr. can be built.

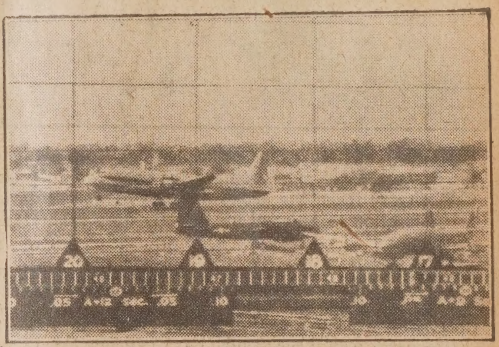
BIG PLANES STUDIED FOR TAKE-OFF



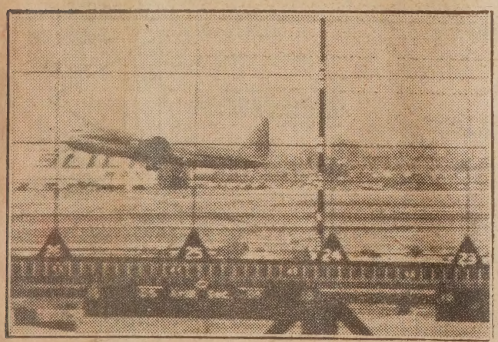
Clearing the runway at a steep angle, the US Lockheed Constitution is photographed on a test flight by engineers operating Lockheed's unique grid-camera installation to record take-off and performance with an accuracy of 1/100th of a second. Precision alignment of the grid wires and timing of the camera permit exact mathematical determination of a test airplane's take-off and landing performance, never before possible. In the middle foregound is the sister ship of the first Constitution.



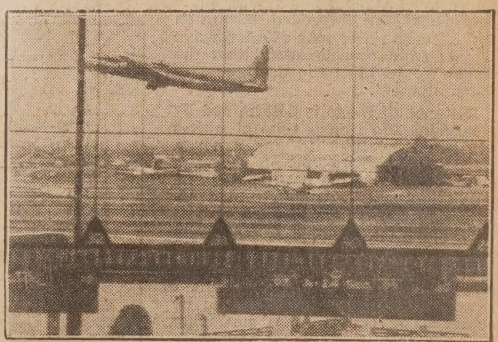
The Constitution is off the ground at about 2000 feet and after about 20 seconds in this grid camera picture.



The Constitution at 2600 feet is a little more than 25 feet off the ground as shown by horizontal wire of grid.



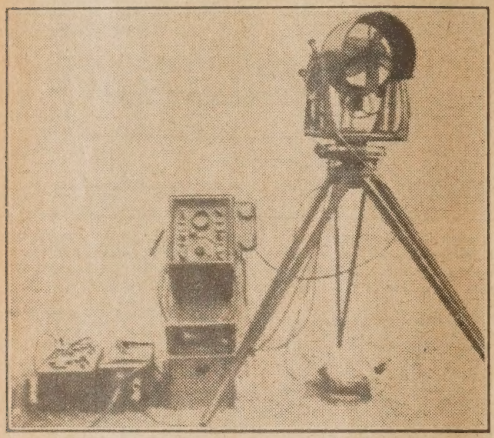
Nose of the Constitution points at the 100-feet altitude mark on the grid camera film as the landing gear starts to come up. Vertical wire shows the 3200-feet runway mark and timing tape at bottom of picture indicates 28 seconds have elapsed.



The US Navy's Lockheed Constitution has gone about 1550 feet on its take-off run in this grid camera picture. Numbers on triangles at bottom of vertical wires mark off runway in 100-feet sections.

Technical Review

SURVEYING NOW POSSIBLE BY PULSED-LIGHT RADAR



This picture shows the equipment set up and ready for use in the field. The operator takes up a position on front of the C.R. tube. He can elevate or rotate the optical head by a system of cranks and flexible shafts attached to the scope unit. The equipment breaks up into units, which can be carried.

★

Equipment utilising radar principles has been designed to speed up survey work. Light pulses replace the usual radio signals but the familiar C.R. display technique allows distance as well as deviation and declination to be read off directly from calibrated scales.

THE new optical-electronic instrument is capable of making a survey of terrain when conventional survey methods would be too slow or when long traverses over inaccessible terrain are needed.

The choice of light instead of microwave radar signals was made because of the improved resolution and because reflections of microwave signals from objects other than the target would limit the usefulness of the equipment.

Distance of range is determined by measuring the transit time of pulses of light travelling to and from a retrodirective reflector placed at a point whose relative position is to be found. Angles are determined by adjusting the position of the optical transmitter to produce a maximum return pip on a cathode-ray tube.

The accuracy of the survey which can be obtained with this instrument is not as good as that which can be achieved by conventional surveying methods but it compares favorably with the accuracy of a third-class survey.

The overall method of operation of the system is shown in the block schematic. When the flashlamp in the optical transmitter breaks down, it triggers the sweep generator and causes a trace to appear on the cathode-ray tube. The light pulse transmitted by the lamp is returned from the distant reflector and falls on the cathode of the photomultiplier causing a pip to appear on the trace.

Upon returning to its normal state the sweep generator triggers the second sweep timer, which gates the range and trigger pip generators. These produce a second trace displaying range pips which can be matched with the target return pip by adjustment of the phase shifter.

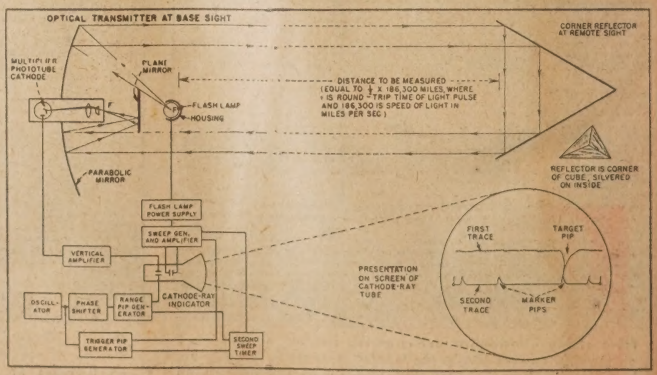
When the second trace is completed, the circuits return to their normal states and are ready to repeat the cycle when the lamp flashes again.

FOUR MAIN UNITS

The instrument consists of four main units, called the optical head, the scope unit, the main power supply, and the converter unit.

The optical head is mounted on a tripod and contains the flash-lamp and optical system necessary for transmitting the light from the lamp, receiving it from the distant reflector, and focusing it on the cathode of a photomultiplier.

The output of the photomultiplier is amplified by a two-stage amplifier which is also part of the optical head and is contained, with the multiplier, in a chassis attached to the rear of the mirror housing. The optical head is mounted on bearings attached to graduated circles that per-



This block diagram shows how the travel time of a light flash is used in surveying.

mit its elevation and rotation to be determined within one minute of arc.

The output of the amplifier is fed through a delay line to the scope unit, where it is amplified by two additional stages of amplification to produce the vertical pip on the cathode-ray tube. The scope unit is mounted on top of the main power supply during operation and can be tilted for convenience of an operator seated in front of it. This unit contains in addition to two stages of vertical amplification and the cathode-ray tube, the sweep circuits and other circuits necessary for the precise determination of range.

The entire equipment is designed to operate from 110 volts, 60-cycle A/C power or from a 12-volt battery. When D/C operation is desired, a 12-volt D/C to 110-volt A/C rotary converter contained in the converter unit is used. This unit also contains a neon sign transformer and rectifier to operate the flash-lamp.

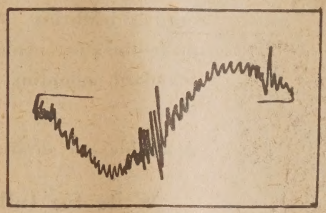
The flashing rate of the lamp is controlled by varying the voltage fed to the primary of the neon sign transformer by means of a Variac located in the main power supply. This unit supplies the plate and accelerating voltages to the tubes in the scope unit and in the optical head. (Illinois Institute of Technology, Chicago. From "Electronics," July, 1948).

NOISE MODULATION IN RECORDING

Writing in a recent issue of "Audio Engineering," E. G. Cook examines the question of noise modulation in lateral cut discs and suggests that it is responsible for much of the distressing distortion frequently blamed on other causes.

WHEN a stylus is cutting an unmodulated groove the apparent direction of travel is exactly at right angles to the cutting surface. A subsequent test on the groove for noise level may indicate that the characteristics of stylus and recording medium are entirely satisfactory.

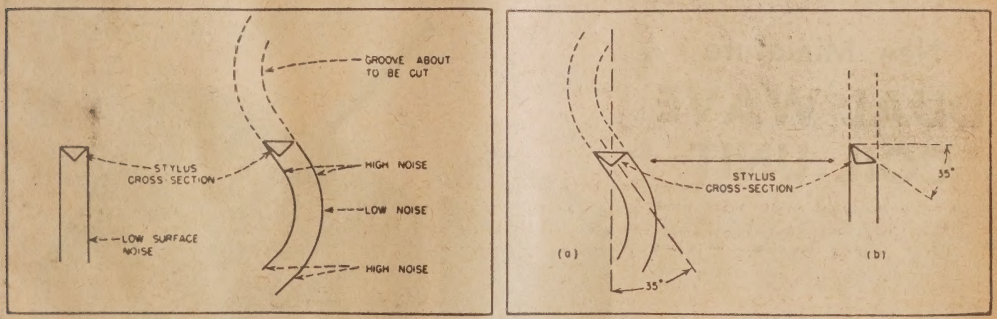
However, under modulation, the stylus is vibrating rapidly from side to side, so that its instantaneous



A sketch of an oscilloscope display showing the generation of noise at points corresponding to maximum cutter velocity.

Summing up the effect of the listener, the writer says: "The effect of pronounced noise modulation in recordings is that of producing rasping high frequencies—hoarseness as distinguished from amplitude distortion, an unnatural timbre difficult to describe, but immediately recognised as a familiar sound by the practical listener. Noise modulation is probably largely responsible for effects which have been variously described in the literature as 'a peculiar magnetic distortion,' 'pinch effect,' 'tracking trouble,' &c. By all means, this is not to deny these various other worthy factors their well deserved individual niches in the recording Hall of Fame, but rather to point out that noise modulation has always been present in lacquer recordings and in records pressed from lacquer originals to such a degree that in some cases it may have been a potent factor in listening tests.

"It might be guessed at this point that the whole matter of noise modulation is peculiarly tied in with the making of lacquer discs, and as such



The low noise level measured in a dead groove, as at the left, applies only on peaks when a signal is present. A more representative test would be to cut a dead groove, as on the left, with the stylus rotated some 35 degrees from its normal position.

ELECTRON TRACKS

ELECTRON tracks have been reported seen for the first time with the aid of a new photographic emulsion, Eastman Kodak Laboratories announced last month.

Electron tracks in emulsions were reported from the University of Montreal in 1946, but the new Eastman tracks, first obtained in the company's laboratory at Harrow, England, and later in Rochester, N.Y., are long enough to remove all doubt as to their identity. The number of developed silver grains in a track on the emulsion ranges from six to a maximum of twenty-eight. The length of the path in an emulsion is about two thousandths of an inch, so that a microscope must be used to see it.

movement is at an oblique angle across the surface of the disc, first in one direction, then the other. Only on modulation peaks, when the stylus comes to rest for an instant, is it cutting at the correct angle. At all other times the effect is as if the stylus were improperly mounted in the recording head so that its face is presented at an oblique angle to the direction of travel.

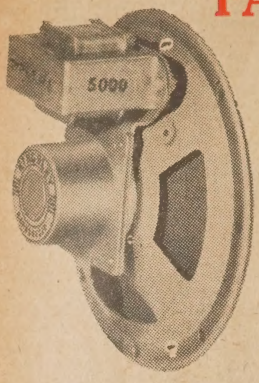
Under these circumstances, there arises an entirely new set of conditions in which the stylus may cut imperfect grooves, depending on the steepness of the wave front, the shape of the stylus and the nature of the recording medium. The effect is obviously most serious with rising frequency, increasing amplitude, or decreasing lineal speed. Although the noise, as such, is masked by the modulation, it nevertheless has a serious effect on ultimate quality by a complex process of intermodulation.

is associated with the polishing or burnishing surfaces of the cutting stylus used for lacquer recording. It is true that the so-called feather-edge type of stylus used in the making of wax masters probably did not produce much noise modulation and had a high Factor of Merit. It is equally true that in those days when wax masters were the rule rather than the exception, processors may have wiped with less abandon than they do today.

"In any case, the solution to the noise modulation problem is certainly not a return to the use of 'wax' for originals, with its inconvenience and increased cost of handling. Recent developments made in collaboration with Frank L. Capps and Co. have culminated in a positive solution to the problem, and a superior type of MRS with anti-noise modulation properties will be available for lacquer recording within a few weeks."

The Latest Addition to the range of

FAMOUS KINGSLEY SPEAKERS



5" Permag.

TYPE KR5

The KR5 Speaker is the latest addition to the already famous range of Kingsley Radio Speakers. Illustrated at left—This Kingsley Speaker has new and improved seamless cone. Imported British magnet, featuring "Alcomax 2"—the highest grade magnetic alloy made. Cadmium plated housing. Standard mounting. Full-size matching transformer.

Available any desired impedance.

Write for full details of the KR5.

Retail Price 29/6

New Miniature

DUAL WAVE COIL UNIT

This new Kingsley Dual Wave Coil Bracket has not merely been reduced in size—it has been thoroughly designed by Kingsley's Research Engineers. It is no mere adaptation of existing components, being engineered not only from the electrical but also the mechanical viewpoint.

No Other D/W Bracket gives All These Features:

- Each unit is core tuned.
- Models for every converter valve.
- Frequency coverage 5.95 megacycles to 18.5 megacycles and 540 to 1650 kC/s.
- Trimmers and cores are readily accessible.
- Coils and wiring well protected.
- Dimensions of unit: 3 ins. wide 2 ins. deep, 1¾ ins. high.
- Ease of wiring into chassis.
- Sturdy construction of unit.

Write for further Details.

The Kingsley Dual Wave Coil Unit is photographed here alongside a match-box for size comparison.

Retail Price 37/-

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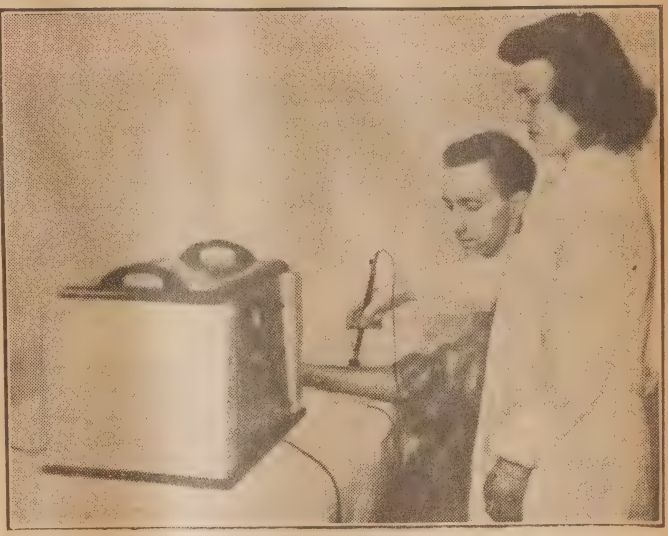
ELECTRICAL STIMULI NOW MADE TO ORDER

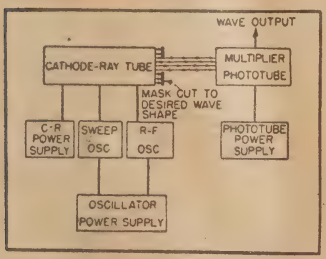
A new electronic circuit for medical diagnosis and research will produce any desired wave form when its shape is cut from cardboard and placed between a CR tube and a multiplier photo tube. Wave characteristics become available which are difficult or impossible by means of ordinary electronic circuits.

THE device was designed to provide either single or repetitive stimuli derived from a simple silhouette easily cut by following any desired curve drawn on cardboard or similar material. The mask so obtained is placed in contact with the screen of a cathode-ray tube having a short-persistence phosphor.

The beam of the cathode-ray tube is spread vertically into a thin line by a radio-frequency oscillator connected to the vertical deflecting plates. The line thus formed is caused to move from left to right between two definite end points on the silhouette. The motion is obtained by the relaxation oscillator circuit.



Square-wave stimulator, showing technician applying stimulus to muscles of forearm.

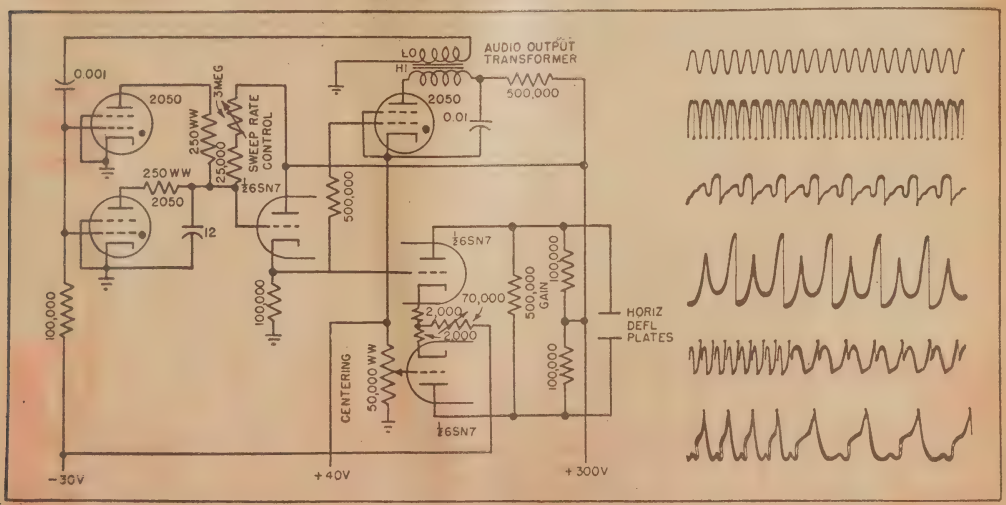


Block diagram of system for generating stimulating current whose waveform is cut out from cardboard mask.

An RCA 931-A or similar multiplier phototube is placed about eight inches from the face of the cathode-ray tube. The amount of light which falls on the phototube is a function of the length of line which it sees at any instant, and this is determined by the shape of the mask. The output of the phototube is approximately 10 volts with a 750-volt power supply and a 50,000-ohm load resistor.

The light-sensitive surface of the phototube is of proper size, so that no lens system is necessary to provide uniform output for a given length of line at any position between the fixed end points of the mask, provided the distance from the screen to the phototube is not less than eight inches.

The output of the phototube may be amplified by a d-c amplifier and applied to the organism, as desired.



Relaxation oscillator circuit used to sweep vertical-line trace across cut-out mask at desired frequency for generating medical stimulating current, and examples of waveforms generated. Lower two records show result of varying sweep rate.

NEW METALS NEED NEW TECHNIQUE

Normal methods call for pouring molten metal into moulds. Showers of sparks, heat and glare accompany this spectacular process.

Enormous developments have marked the progress of metal working during the last 50 years. Improved handling methods and the use of alloys have combined to produce a host of special-alloy products for modern needs. This article tells of some latest developments which have proved important to man and his industries.

THE marked increase in industrial expansion over the past few years has created enormous demands for new metals and other materials.

Not only has the production of the well known metals been enormously increased, mainly due to war needs, but new processes have had to be devised to deal with the manufacture of new alloys which are now required in industry.

The output of such metals as copper, iron and tin has been doubled over an average period of 15 years, while aluminium, which 50 or so years ago was manufactured in amounts of a few pounds, is now produced in over million-ton lots. This is a vast quantity in bulk, considering its light weight.

Because of the increasing demands of the engineering industry for metals of high strength, and resistance to wear and heat, the rarer metals of tungsten, molybdenum, beryllium, vanadium, cobalt and so forth are now widely sought. These metals occupy an exalted position by reason of the fact that they produce, in combination with steel and other common metals, alloys of great advantage.

Although these metals are comparatively rare, this scarcity is balanced by the fact that large quantities of them are not necessary to bring about the desired result.

For instance, pure iron is softer than copper, but the addition of less than 1 per cent of carbon converts it into a steel which can be hard enough to scratch glass.

Of course, carbon is one of the commonest of elements, but the example has been given because it was by reason of the understanding of the process of admixture that led to the introduction of other elements.

The mixing of copper with a little over two per cent of beryllium converts it into a metal hard enough to make springs. Similarly, lead is made more resistant to the action of frost by the addition of .05 per cent of tellurium. The advantage of this is made use of in making water pipes for cold climates.

Larger additions of the rarer metals to the more common ones have remarkable results. The manufacture of stainless steel was made possible by the discovery that ordinary steel became resistant to rust and corrosion by the addition of about 14 per cent. of chromium.

MODERN MAGNETS

In the manufacture of the new wonderful permanent magnets seen on the back of modern loudspeakers, advantage was taken of the excellent magnetic properties of steel mixed with aluminium and nickel or cobalt and copper.

The discovery of this alloy for magnet steels has led to a most remarkable increase in the efficiency of the present-day loud-speaker, both as regards sensitivity and tonal qualities. In addition, the advantage of light weight is apparent.

The new magnets also have their uses in the engineering industry. Here they are used for magnetic chucks for holding work in grinding or milling machines.

Many products which use the rarer metals are in everyday use, but the average person doesn't think much about it. A fountain-pen nib, for instance, is usually tipped with an alloy of osmium and iridium. This alloy is highly resistant to corrosion and wear.

The light from our electric lamps

VACUUM METALLURGY MAKES THEM

by Calvin Walters

(between blackouts, of course) is furnished by a thin filament of tungsten. This metal is used because of its high melting point—3650 degrees Centrigrade.

When one finds a cigarette-lighter which works, it is an alloy of iron with the metal cerium, which produces the spark. Cerium is also used to make the "trace" in tracer bullets used in warfare.

Much electroplating is now done with cadmium, and chromium for protection against corrosion and wear. Rhodium and Indium are used for the same purpose. Tantalum is used for the making of the spinnerets through which raw material passes in the manufacture of artificial silk.

The new processes have brought many problems, among which is that of coping with the very high temperatures necessary to melt some of these rarer metals.

Ordinary metallurgical methods are useless for many of them, as it is difficult to find refractory materials for furnace construction or crucibles which will stand temperatures over about 1600 degrees Centrigrade. Ordinary fireclays crumble and become soft at such high temperatures, and are subject to attack by the slags formed during smelting.

Up to the present only a few of the oxides of such elements as alumina, thoria, magnesia, &c., have been found to suit the purpose. These must be used in a very pure state, as only a very small proportion of impurities will reduce their excellent properties considerably.

SPECIAL OXIDES

It is thus necessary to employ highly specialised processes in the preparation of these oxides for use, and this has been done so far only in the laboratory. Nevertheless, the future will surely see an extensive use of these oxides for metallurgical processes.

In the meantime, methods have been devised to heat metals without the necessity of the heat passing through the crucible in which the metal is contained. This has been accomplished by means of induced electricity of high frequency.

HEAT RESISTANCE

This electrical process allows the heat to be generated where it is most required, so that it is possible to contain the metal in a vessel which remains cold. It is possible also to carry out the process in a vacuum or in an inert gas.

The new vacuum metallurgy has some startling facts and advantages to offer, and it is well to give this process in some detail.

The search for special metals, which will withstand the terrific heat generated for long periods in jet engines, has stepped up the research in vacuum metallurgy, for the alloys used require rare metals, such as chromium and molybdenum, which have very high melting points.

Super alloys for jet engines must be of the best possible quality, free from flaws, dense and tough. Vacuum metallurgy makes this possible.

It is interesting to consider the simple theory of vacuum metallurgy, for it is based on a phenomenon well known to everybody.

Every schoolboy knows that on a high mountain top, water will boil at a lower temperature than at sea level because the atmospheric pressure on a mountain is lower than it is at sea level. In other words, the higher we go, the closer we approach a vacuum, and the lower becomes the boiling or melting point.

It follows then that if we create an artificial vacuum, we should be able to melt metals within it at a temperature much lower than their normal melting point. This is exactly what happens, and it has been found that it is possible to reduce the melting points of some metals by as much as 1850 degrees Fahrenheit lower than the normal.

VACUUM CHAMBER

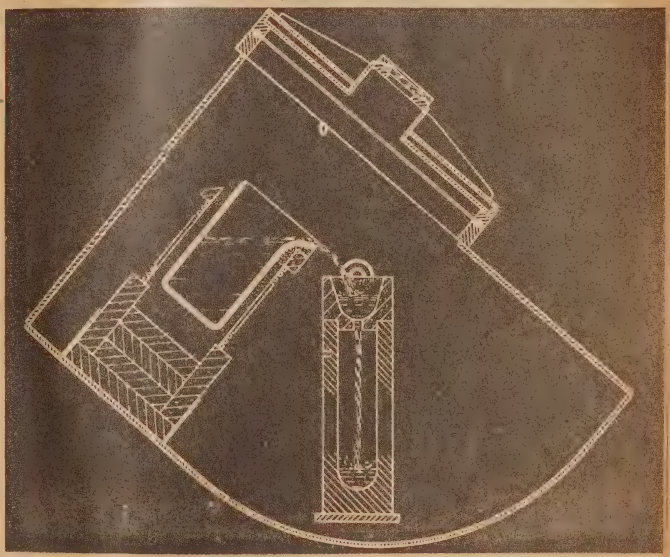
In practice, the metal is enclosed in a container within a chamber from which the air has been exhausted as completely as is humanly possible. The chamber is sealed with rubber gaskets, and sometimes windows are provided so that the melting operation can be observed.

Melting of the metal is carried out by high frequency induction units, and here it is well to point out that vacuum metallurgy has so far been carried out only with the melting of metals for the removal of impurities, &c. It is not possible yet to use the process for the actual smelting of ore, as no methods have been devised to cope with the slagging operations required in smelting.

Means are provided for pouring the molten metals into moulds whilst still in the vacuum. It is obvious that it would be fatal to remove the molten metal from the vacuum for pouring, for this would expose it to atmospheric gases, the removal of which is one of the reasons for vacuum-melting it in the first instance.

The two diagrams herewith illus-

(Continued on Page 29)



Special metals of today are made in this vacuum furnace, in which air is excluded from the entire process.

ROCKETING EVER HIGHER IN PUBLIC FAVOUR

It is now a widely accepted axiom that "a good radio *deserves* Philips Valves—and a so-so set really *needs* them." Philips Valves are designed and made to give *better listening for a longer time*—and every buyer of radio or radio parts knows how completely this objective has been achieved. No matter what type of receiver yours is, you'll find that Philips Valves put it right on top of its form.

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V8A-47

POPULAR SCIENCE DIARY

By PROFESSOR A. M. LOW, ENGLISH WRITER, SCIENTIST

In these days of utility, economy, and other nasty things, the idea is often put forward that trains waste countless sums of money by putting brakes on the wheels. The brake turns the inertia of several hundred tons of metal travelling at 90mph into heat, while sparks fly as the metal from brake-shoes, rails and wheels is cast to the four winds.

ONE might mention, in passing, that when a certain electric underground railway was being silenced by the interesting plan of preventing the reflected noise wave from striking the direct wave near the passenger's ear, it was necessary to line certain parts of the tunnels. The dust of metal from the brakes was so fine that it settled in the noise-absorbing substances round the tunnel and became positively explosive. Finely-divided metal will burn in air like gunpowder.

In the hope of saving some of this loss, all kinds of ideas have been tested. At one time stations were built at the top of a slight rise in the rails so that the trains would be stopped going uphill and helped to start when going down. Like many another case of compromise the civil engineering troubles outweighed any advantages. Another inventor tried to use the braking energy to make electricity and thus to "recharge" the system. This is a partial success and is, of course, well known.

In electric motor cars the trouble is one of storage, for no one has yet produced the light and perfect accumulator. One day an inductive transmission or condenser capacity storage may solve the problem, but until then it actually does not pay to bother about recovering these serious losses. The waste of heat for which we have all paid on any big railway during one year may run into millions of pounds.

MEN ON MARS!

I often think that we would have reached the moon and other planets far sooner if we knew that there was gold on their surface. But I do not think there is what we call human life on any planet unless it chances to have the same conditions as those upon the earth.

Life, as we know it, is the result of climate and many other circumstances. It might well be that on Mars totally different geological values have produced a different form of life. Beings might move things by thinking. They might see by what to us is heat, for these are merely relative matters of sensitivity to a certain set of wavelengths.

It will have occurred to you that the vast distances between us and other worlds could only be traversed at speeds inconceivable to our minds. Light is quite quick at 186,000 miles a second, but if on any of the stars they could see the earth by ordinary light the views would have taken so long to travel that by this time they might be watching Julius Caesar or be betting upon chariot races round the arena.

I was talking of averages to a sportsman the other day, and it was made clear how many people "slip up" over the simplest sum. Just suppose someone offers you a lift home, twenty miles away, and drives for forty miles an hour for the first ten miles and then, when you tell him to step on it, at sixty miles an hour for the second ten miles, what is your average speed?

Nine out of ten people will reply instantly, "Fifty miles an hour." But the right answer is 48 mph. You take fifteen minutes to cover the first ten miles and ten minutes to cover the second ten miles—total twenty-five minutes for twenty miles, or 48 mph.

This shows how deceptive averages can be. A certain quartermaster reported, quite truthfully, that the troops on a campaign had been supplied with the average rations. But this did not mean there were no grounds for complaint. Some of the men had next to nothing, while others had double rations. Nevertheless, the average was the correct amount.

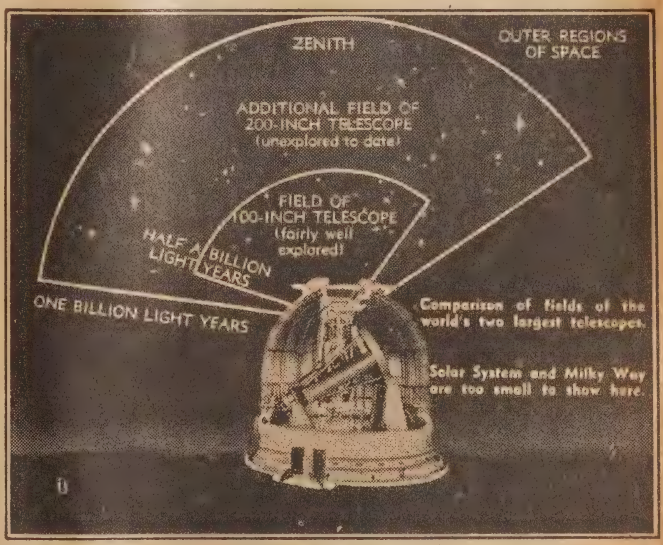
You may or may not know that the stars that twinkle so brightly are not the many-pointed objects which artists draw. In truth, they are anything but star-shaped. The tremendous forces and speeds of the heavens call for everything being round and ready to travel in curves. This is clearly shown in photographs.

POINTED STARS

The many-pointed appearance of the stars is due to the unsteadiness of the earth's atmosphere, arising from unequal heating of the air as well as to physiological causes. The twinkling is caused by the air, and not by the star. The light is unequally refracted and gives a distorted appearance to its source—the same effect is produced if a candle is looked at through agitated water.

This unsteadiness, by the way, is a great handicap to the astronomer who, at the best of times, has to be constantly adjusting his telescope as the star appears to move.

Incidentally, the refraction of the earth's atmosphere bends the light from the sun and the moon, with one curious result. When they have actually disappeared below the horizon we can still see them, apparently just above the line.



The world's largest telescope, the 200-inch giant at Palomar, USA, is now believed to be in action. Twice as big as its companion at Mt. Wilson, 90 miles away, it can see up to one billion light years, and cover eight times as much volume of space. With its mounting, and fine precision control, it weighs 500 tons. Its dome is controlled for both temperature and humidity.

VEALLS HAVE EVERYTHING FOR THE RADIO ENTHUSIAST

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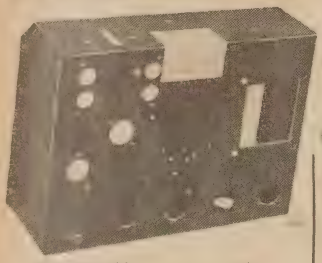

Xmas Portable _ _ _ _ _ 7/11
Handle Talkie _ _ _ _ _ 3/8
Little General _ _ _ _ 7/11
1947 Advance 5-valve _ _ 10/11
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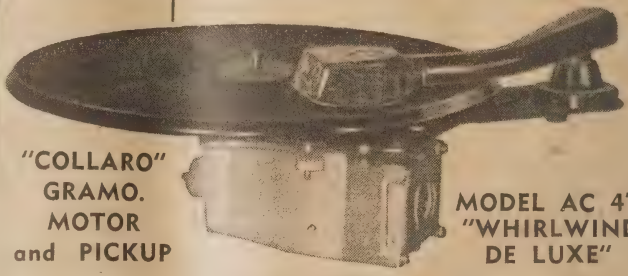

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MODEL AC 47 "WHIRLWIND DE LUXE"

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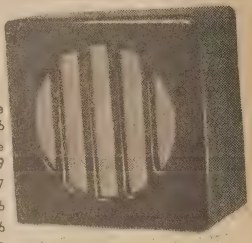

Handle Talkie Portable 30/6
Standard 5-valve Portable 46/9
6" Speaker Box _ 19/7
8" Speaker Box _ 23/6
10" Speaker Box _ 28/6
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"Tecnico" Low-Pressure pickups

MODEL FP8—Crystal pickup with permanent built-in sapphire stylus, and low needle pressure. Uses LP6 Astatic Crystal Cartridge. Frequency range, 50-4500 c.p.s.; Needle pressure, 1oz.; Overall length, 9⅜in. For use with 10in. and 12in. records. PRICE _ _ _ _ _ _ _ _ **£6/9/-**

MODEL FL48—This is a replaceable needle pickup for general use, offering improved performance due to lower needle pressure, 1½oz. and higher needle point compliance. Frequency range, 50-4500 c.p.s. Equipped with type L-40 Astatic Crystal Cartridge. PRICE _ _ _ _ **£5/4/-**

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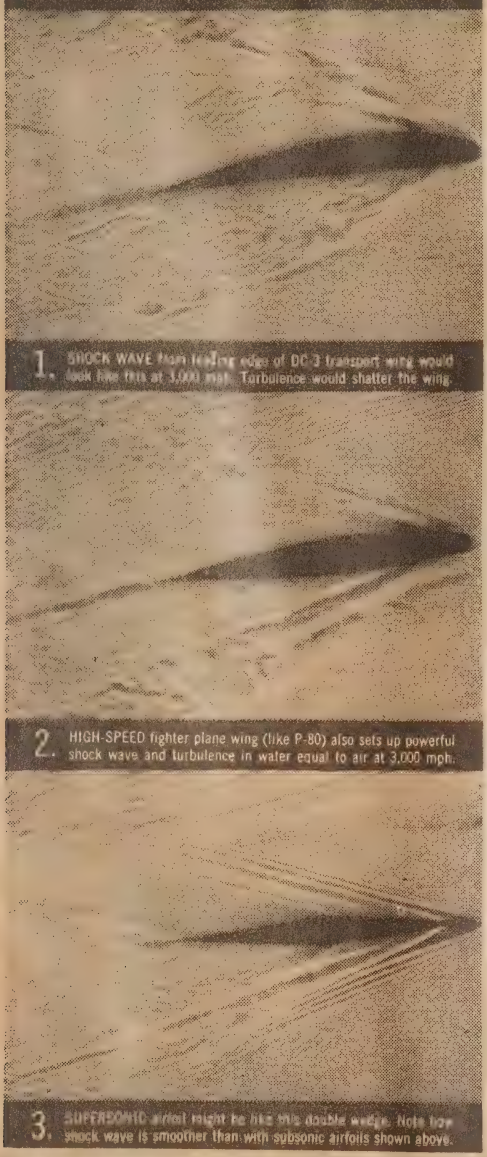
WATER TESTS AID AIR RESEARCH

WING SHAPES, TODAY AND TOMORROW

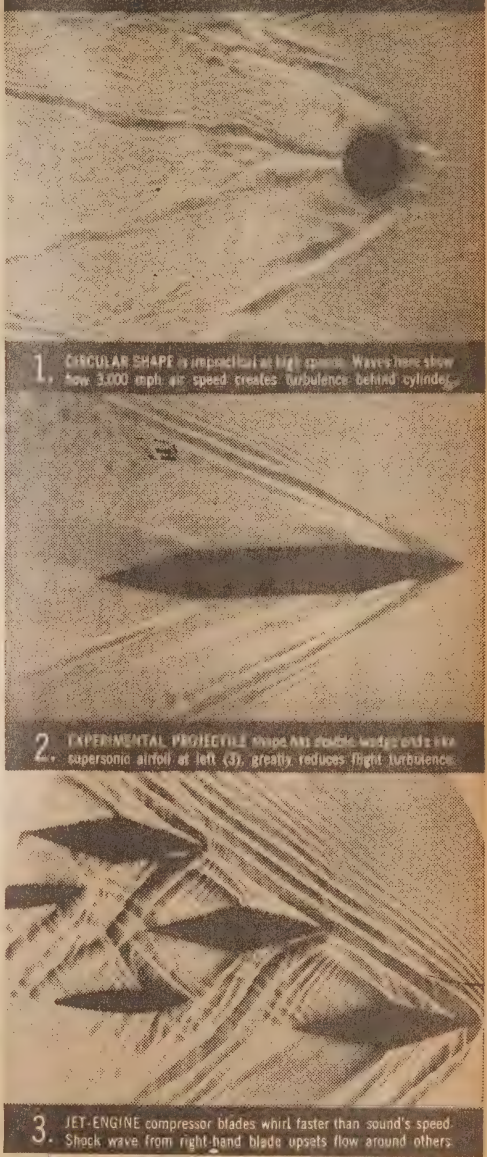


1. SHOCK WAVE from leading edge of DC-3 transport wing would look like this at 3,000 mph. Turbulence would shatter the wing.

2. HIGH-SPEED fighter plane wing (like P-80) also sets up powerful shock wave and turbulence in water equal to air at 3,000 mph.

3. SUPERSONIC airfoil might be like this double wedge. Note how shock wave is smoother than with subsonic airfoils shown above.

PROJECTILES AND TURBINE BLADES



1. CIRCULAR SHAPE is impractical at high speeds. Waves here show how 3,000 mph air speed creates turbulence behind cylinder.

2. EXPERIMENTAL PROJECTILE shape, as double wedge, acts like supersonic airfoil at left (3), greatly reduces flight turbulence.

3. JET-ENGINE compressor blades whirl faster than sound's speed. Shock wave from right-hand blade upsets flow around others.

BY using water streams, scientists are able to forecast the behavior of solid sections in fast-moving air—knowledge essential in the design of aircraft wing sections and supersonic projectiles. General Electric's engineers claim they can simulate with this method two-dimensional air flows up to 10,000 mph. In this latest form of research, the mathematical answers are applied with appropriate corrections to forecast accurate results when the same cross sections are moving in high-speed flight.

MEASURING HEAT OF MOLTEN METAL

Ordinary thermometers are of little use when measuring the melting point of metals. In this and similar work, new devices must be used. The pyrometer is simple and effective.

ELECTRICAL thermometers of the type used in furnaces depend on the fact, established by Professor Callendar 60 years ago, that the resistance of a platinum wire to the passage of an electric current varies in accordance with the temperature.

As the variation is subject to a definite law and as the resistance of pure metals increases with the temperature, it was realised that an instrument could be constructed by which the resistance of the wire could be read off in terms of its temperature. The accuracy achieved far exceeds that given by an ordinary thermometer dependent for its reading on the expansion under heat, of liquids, solids or gases.

The first sketch shows in diagram form, Professor Callendar's resistance thermometer connected up with a galvanometer. This thermometer makes it possible to read accurately temperatures ranging from zero (—273 deg. Cent.) to 1200 deg. Cent.

Platinum wire is wound on quartz and covered with a quartz tube. The thermometer is placed in the furnace and the wire assumes the temperature of the furnace.

Resistance to the current passing through the platinum wire is affected by the heat of the substance. The resistance is recorded on the galvanometer placed in circuit with the wire. From the deflection of the needle, the temperature can be worked out.

The calibrated scale on which the reading is taken may be placed at a control point distant from the furnace, where other readings or controls may be centralised.

Another type of electric heat-measuring instrument depends upon a pecuilar effect discovered by Peltier.

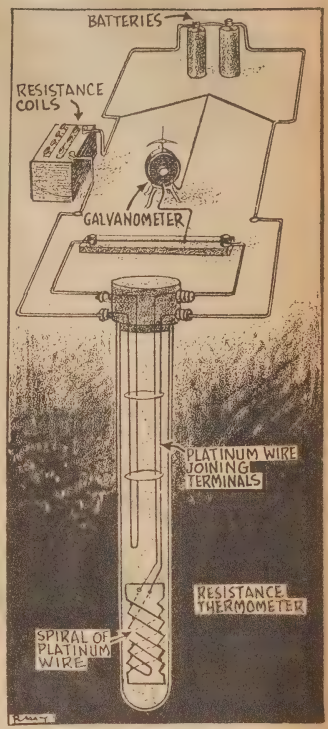
Over 100 years ago Peltier found that when an electric current is passed across a junction of dissimilar metals, the junction is either heated or cooled, depending on the direction in which the current is travelling.

The second sketch shows a simplified version of a pyrometer of this type. The circuit, known as a thermo-couple, makes it possible for pyrometers to be constructed that are so delicate in operation that the minutest differences in temperature can be detected with them.

Wires of pure platinum and platinum alloy are fused together and their junction is protected by a fireclay tube. This is placed in the crucible containing the molten metal, or in the furnace. The other junction is maintained at a constant temperature in a vessel of steam.

The free ends of the wire are connected to the terminals of the galvanometer, and the temperature can be calculated from the variation in the electrical resistance of the wires composing the thermo-couple.

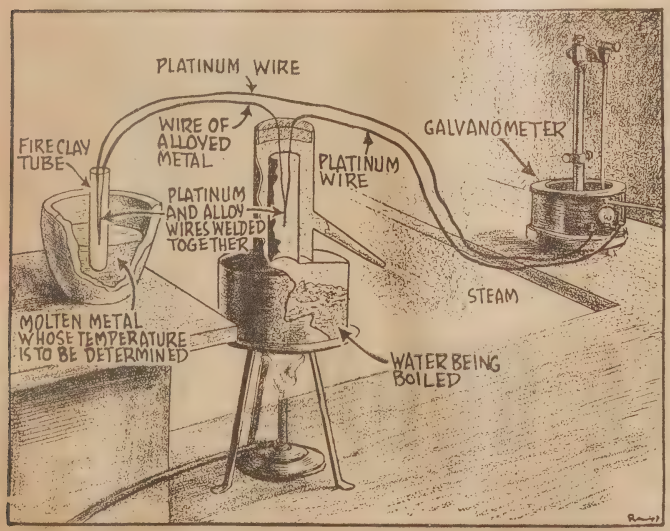
A pyrometer of this type measures with exactness the extreme range of temperatures of the hottest furnaces, and (by special modification and by use of a very delicate galvanometer) can be set up to measure differences of temperature of one 1,000,000th of a degree Centigrade.



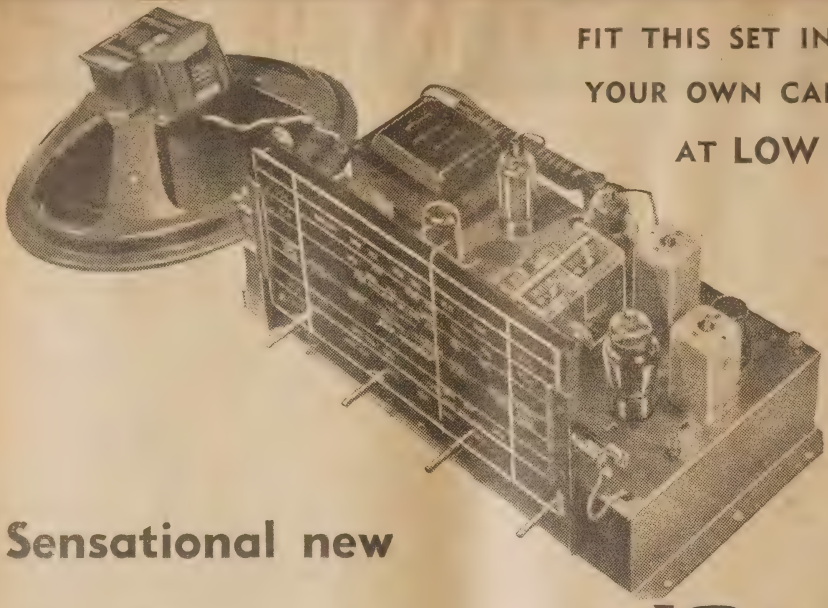
One of the most widely-used arrangements of couples employs one element of platinum and the other an alloy of 90 per cent. platinum and 10 per cent. rhodium.

If it is desired to obtain a graphic record of the changes in temperature of a furnace, a relay circuit can be introduced, the deflection in the galvanometer pointer being made to operate a small lever moving a pen to right or left along a strip of paper mounted on a revolving drum.

The pyrometer indicator may be placed at a considerable distance from the place where the thermo-couple is fixed.



About four persons in every hundred have defective color vision, sometimes amounting to definite color-blindness. The complaint is sometimes called "Daltonism" after John Dalton, famous English physicist, who carried out extensive research on color-blindness during his lifetime—1766-1844.



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NEWS AND VIEWS OF THE MONTH

Radar Aids Blind

RADAR, the British discovery which played a great part in winning World War II, in a few years may enable the blind to "see," at least to the extent of avoiding obstacles. Scientists of the Telecommunications Research Establishment at Malvern, England, are now attempting to develop a hand radar set for blind people. The development of radar made it possible to make photo-conductive cells produce images on a fluorescent screen, and the scientists are now trying to use the sound waves in the same way that radio waves are used in radar—to give echo warnings. It is hoped that a portable apparatus will be produced which will warn the blind of a wall, a tree or any other obstruction which may bar their path.

This possible development of radar was suggested in Radio and Hobbies more than two years ago. It is good to hear that it may become fact in the near future.

Air Pockets at Height

Every other day from Cranfield aerodrome, near Bedford, England, a British-European Airways Mosquito takes off in search of the "bumps" or "air-pockets," which are threatening to hold up the world's plans for high speed travel.

The "bump" has now become a major threat to progress and, in the words of Mr. N. E. Rowe, the leader of the research team for which the Mosquitos collect data, "Unless we find a solution, passenger flying will remain pegged at present speeds.

It is to find that solution that the Government of Britain has asked British-Europeon Airways to fly over Europe with specially equipped aircraft investigating the problem. The air bump has now become such a deadly foe because it has been found to exist not only in clouds but in the once supposedly clear, calm air which lies "above the weather" at 30,000ft. Since these gusts seem to lurk at the heights which the fast new gas-turbine machines are proposing to use, and since their violent effect is multiplied by the cube of the speed at which they are hit, then obviously all civilian operators have a major problem on their hands.

So far as can be seen at present the gust areas seem to be anything between 50 and 100 miles across, and about 1500ft. thick. They seem to occur anywhere at any time and there is, as yet, no theory as to their cause.

As this is an international problem, all countries in Europe have been notified of the experiments, and all are co-operating. In the United States, too, facts are being gathered and it is likely that more and more international scientific effort will be devoted to this, one of the most perplexing problems of modern aviation.

ELECTRONIC LIGHTING ALARM

A DEVICE developed in South Africa warns of the approach of thunderstorms. It provides two degrees of warning: (1) that lightning flashes have occured within a radius of either seven or 20 miles, depending on the setting of the near-far switch, or (2) that a flash in the immediate neighborhood is imminent.

The first-degree alarm is affected by the electrostatic field between cloud and grounded objects, whereas the second is caused by the flow of corona current from antenna to the cloud overhead. In either case, the alarm serves its purpose: to protect personnel involved in manufacture, storage, and use of explosives.

RADIO CROSSWORD PUZZLE No. 12

ACROSS

1. Type of coil winding.
4. Mark caused by wound.
9. Pioneer tubes. (Two words).
10. Epistles.
11. Work for.
12. Units of E.M.F.
14. Doorkeeper.
18. Greek symbol for resistance.
19. Flux . . .
21. Science of relations between light and electricity.
22. Reliable.
23. Type of coherer.

DOWN

1. Speaker board.
2. Instruments for measuring wavelength of light.
3. Choicest part.
5. You mount sockets on this.
6. Effect of close following echoes.
7. Method.
8. Void.
13. Domestic electrical appliance.
15. Type of inductance coil.
16. Television lighting method.
17. Frothy.
20. Transmission unit.

BELOW: LAST MONTH'S SOLUTION

A	M	P	E	R	E	■	I	M	P	A	C	T
U	■	R	■	E	■	■	■	I	■	N	■	E
D	I	O	D	E	S	■	E	C	H	O	E	S
I	■	T	■	D	E	L	T	A	■	D	■	T
O	D	O	R	■	T	■	A	■	C	E	D	E
N	■	N	O	N	■	C	■	S	O	S	■	R
■	■	■	T	■	R	A	Y	■	N	■	■	■
A	■	B	O	X	■	M	■	M	E	G	■	T
D	O	O	R	■	A	■	D	■	S	A	L	E
C	■	T	■	E	T	H	E	R	■	L	■	S
O	C	T	O	D	E	■	S	I	L	E	N	T
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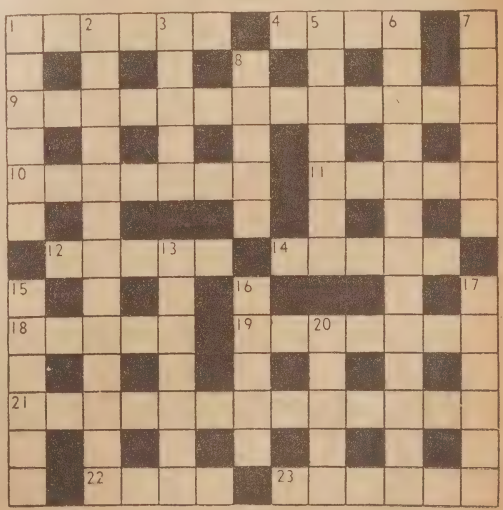


Big Television Plans

LATEST advice from the USA indicates that the radio industry has commenced a sales drive on television, which outstrips any effort yet made in the radio field.

Realising the fact that the industry will become a big one, and can be exploited only by sinking large initial sums of money, both broadcasters and receiver manufacturers are going all out to get both services and receivers in action with the least possible delay.

It is likely that years might well elapse before a major return can be expected from television on a broad plane, but America presents an ideal market for such operation. The huge mass-production industries are used to planning on a scale far beyond our own, and if the initial outlay of millions of dollars can be justified in, for instance, the motor-car industry, American business men see no reason why it shouldn't work out the same way with television, which they firmly believe will be one of the nation's biggest projects of any kind.

They realise, too, that television is something which is not to be compared with other forms of radio. The end result is to provide in the home moving pictures of what is going on in the world. The fact that it uses radio is an incidental to the process, as is also the fact that sound is required to complete the television story. In other words, they are not selling radio, but television, which is quite a different thing.

The result of all this is a co-ordinated drive by all concerned, which seems certain of considerable success.

PRIVATE ENTERPRISE

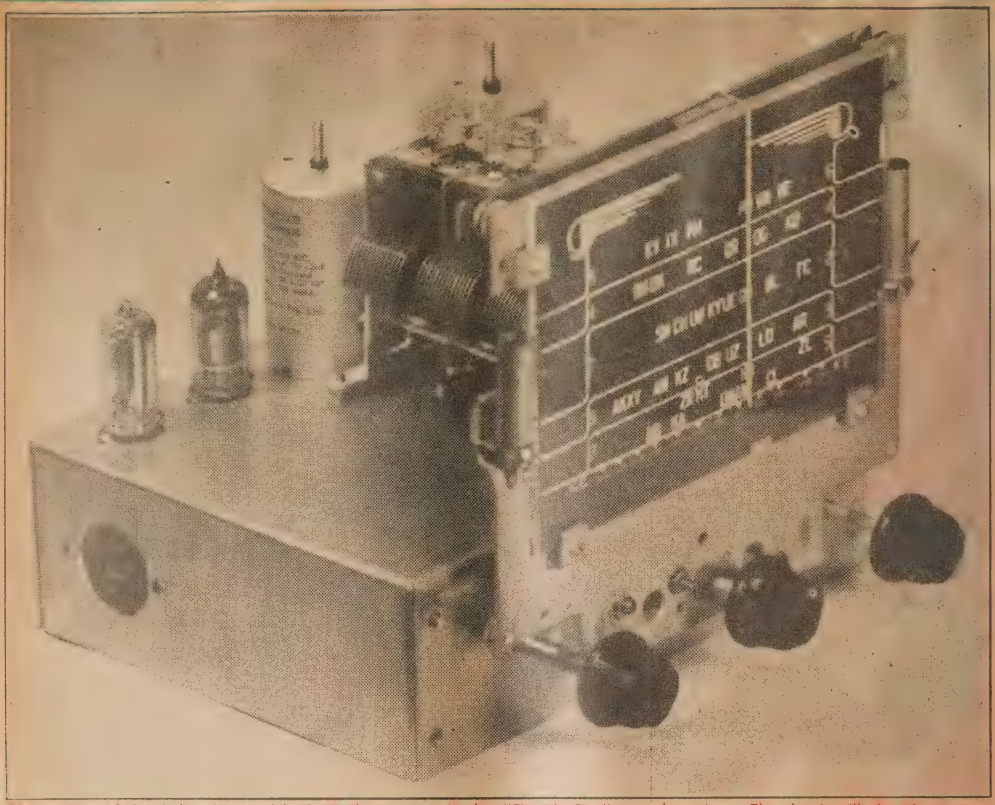
It will be most interesting to see how British and American television develop over the next year or so, particularly because on the one hand we have British television operated by the BBC and paid for from licence fees, while in America the service is operated by private enterprise.

At the moment, American sponsored programmes do not appear to be in use for television, as they are in radio. An American just arrived in this country describes a method by which a listener orders a programme through his telephone exchange, which makes a charge for the service.

The programme required is then beamed in the "viewer's" direction by the television station from a directional aerial having a narrow beam width. This idea seems to have such limitations as will eventually necessitate it being discarded, but apparently it is one approach to helping television pay its way.

Our informant says that great care is taken to avoid television advertising, even to blacking out advertising signs round the baseball parks, so that free publicity won't be given when the games are televised.

This big American effort will be highly interesting to watch as it develops. At present there is no doubt that money is literally pouring into equipment and services.



The position of the dial and control knobs is the same as in the "Fireside Five" mantel receiver. The chassis will alo take a new miniature vertical dial which is to be released shortly.

THE ALL BATTERY FIVE

Here is a receiver which operates entirely from dry batteries, and is, therefore, an excellent set for districts where charging facilities are poor. The five miniature valves operate economically and yet provide ample gain and selectivity for most country listening.

by W. N. Williams

IN the first instance, the 1.4 volt valves were introduced for portable receivers, their particular feature being economy of battery drain. The original "-GT" valves have since given place to the button-based miniatures and further economies have been effected with improvements, in some cases, to the operating efficiency.

Such developments have made possible the design of miniature portables, like the "Multi-Talkie," but they have an interest also for listeners in odd corners of this rather large continent.

By and large, the extension of power lines and the installation of lighting plants have improved the lot of the country listener a great deal, and an increasing proportion of receivers are operating either direct from power mains or from vibrator power supplies.

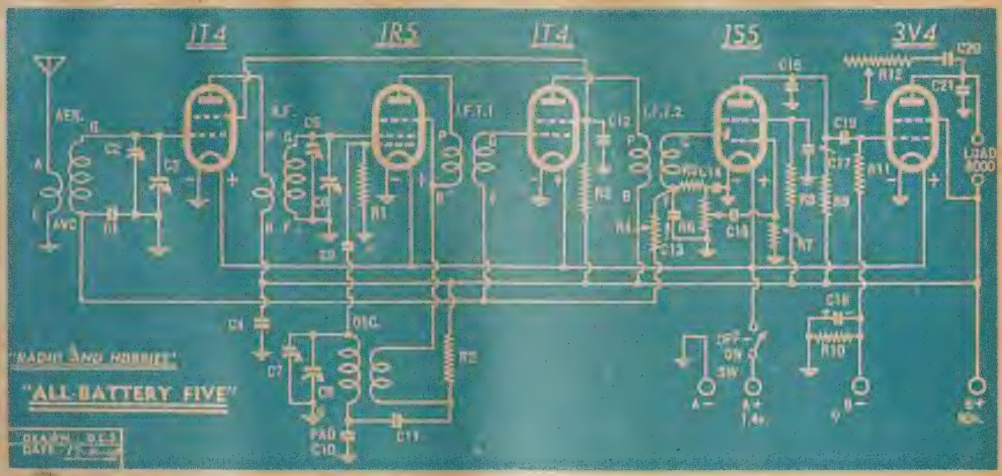
Despite this, however, there are still plenty of listeners who cannot easily arrange for accumulator charging and who have a use for an all-battery receiver. Here, then, is a suitable design.

The bugbear of battery sets is that the "power" bill has to be paid in a lump sum instead of being spread over several smaller payments. The obvious course, therefore, is to render the account as small and infrequent as possible, and the new miniature battery valves help a lot in this direction. Our new "All-Battery" five draws less power for the whole receiver than did a single O1-A valve, in the old days.

As far as the circuit is concerned, the receiver does not differ greatly from the "Springtime Portable," described back in October, 1946. It is assembled, however, on a chassis of more conventional size, suitable for mounting in a table or console cabinet.

Reviewing the circuit, you will note that it provides for an RF stage, the valve being a 1T4. Another 1T4 is

CIRCUIT DIAGRAM OF ALL BATTERY FIVE



The circuit is rather similar to that of the "Springtime Portable," which has already proved its DX qualities. However, a conventional aerial coil replaces the loop and there are other modifications.

used for the IF amplifier and the two derive their screen potential from a common 30,000 ohm series resistor. This provides, just under 50 volts on the screen, under no-signal conditions, and keeps the total plate and screen current within reasonable limits.

It is not usual, in a battery set, to allow all valves to draw their full rated current, even though maximum gain may be achieved under these conditions. If the five valves in this set were to be so operated, the current drain with no signal would be over the 25 milliamp mark!

EFFECT ON GAIN

Checking on the characteristics, however, shows that a reduction in screen voltage from 67½ to 45 cuts the drain of the 1T4 valves in half, but reduces their gain by only 16 per cent. An economy of the same order is possible with the 1R5 converter, while the output valve can be over-biased considerably before the harmonic distortion becomes too objectionable.

For this reason, the two 1T4 screens are fed through a common 30,000 ohm resistor, rather than one nearer 10,000 ohms. You can try a lower value, if you like, but remember that the battery drain will be increased.

For the same reason, the 1R5 screen is fed through a 20,000 ohm resistor instead of a 7000 ohm. Any adverse effect which this may have on the oscillator circuit is largely offset by the provision of padder feedback. Note that the bypass on the oscillator coil goes to the "hot" side of the padder condenser, rather than to earth direct. The padder in the original receiver is a fixed 425 pf mica condenser: other coil kits may require a variable padder, but the circuit connection will remain the same.

Just in case you have not met the 1R5 before, it has no separate oscillator anode. Instead, the normal screen serves a double purpose and this accounts for its apparently strange interconnection with the oscillator coil and first IF transformer.

The detector circuit is quite standard and, in this circuit, we have added an RF filter ahead of the audio gain control. This is generally desirable in such circuits, but reasons of economy and space sometimes dictate its omission from straight portables. Its effect is to prevent a slight whistle or howl which sometimes develops with the gain control turned full on.

The 1S5 has only a single diode plate, which therefore has to serve both for the detector and AVC circuits. Be sure that you get the polarity of the filament right in the 1S5, as a reverse connection will cause loss of gain and severe distortion. Pin 1 is filament minus and pin 7 is filament plus.

LOUDSPEAKER

For reasons already explained, the 3V4 operates with higher bias than normal but the power output is still adequate if fed to a modern loudspeaker. This is a most important point, as the choice between the best modern speaker and an old one can represent a difference of several times in actual sound volume.

The 3V4 was selected, by the way, because of its lower bias requirements and its 90-volt screen rating. On paper it appears at first glance to

PARTS LIST

1 Chassis, 8in. by 6¼in. by 2¼in.
1 small 3-gang (400 pf approx.).
1 dial type USL44, with BC glass to suit gang
3 broadcast coils (Aer., RF, and Osc.).
2 455Kc IF transformers (No. 1 and No. 2 pos.).
5 valve sockets, button-base type.
1 Octal socket.
1 permag. speaker preferably 6in., type 6K or similar.
2 45-volt batteries.
1 1½ volt battery.

VALVES

2 1T4, 1 1R5, 1 1S5, 1 3V4.

CONDENSERS.

C1 .05 mfd. tubular.
C2, C5, C7 gang trimmers.
C3, C6, C8 gang sections.
C4, C11, C12 .1 mfd. 200v tubular.
C9 .0001 mfd. mica.
C10 .000425 mfd. mica.
C13, C14, C16 .0001 mfd. mica.
C15, C17, C19 .01 mfd. mica.
C18, 10 mfd. 40PV electrolytic.
C20 .02 mfd. tubular.
C21 .001 mfd. mica.

RESISTORS

R1 .1 megohm.
R2, .02 megohm.
R3, .03 megohm.
R4, R8 2 megohm.
R5 .05 megohm.
R6 .5 megohm pot. with switch.
R7 10 megohm.
R9 .5 megohm.
R10 500 ohm.
R11 3 megohm.
R12 .05 megohm pot.

SUNDRIES

2 terminals, one red, one black, approx. 12in. shielded cable, 1 octal plug, hook-up wire for battery and speaker leads, three knobs, solder lugs, nuts and bolts, etc.

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be less economical than the 3S4 but the difference is very small in practice, if one considers the implications of back-bias in the circuit.

We elected to use back-bias, firstly because it obviates the need for a C-battery and secondly because it automatically reduces as the high tension batteries run down.

The battery drain works out at about 12 milliamps with no signal input, dropping slightly wth signal. This is quite moderate and within the capabilities of two 45-volt portable type batteries. You could, therefore, operate this set from two such batteries and a medium-sized A-battery, exactly as for the "Springtime Portable." These batteries would fit easily into a smallish mantel cabinet, so that the whole set would become self-contained.

HEAVY DUTY BATTERIES

For maximum economy, however, it would be better to power the set from a pair of heavy duty B-batteries and an A-battery of similar size. You should then be able to forget the batteries for many months. A-battery drain, by the way, is 0.3 amp.

Connection to the batteries and to the speaker was made, in the original set, by an octal plug and socket in the side of the chassis. The wiring is not shown in the circuit, as you may wish to vary the arrangement. It really does not matter how the connections are made, provided they are correct and that there is no risk of shorting.

The "off-on" switch is fitted to the volume control and, once again, you may or may not wish to use a similar arrangement. If you do instal a separate switch, for any reason, get a double-pole type and wire it to break also the B-minus lead. Then you can connect an 8 mfd electrolytic from the B-plus line to chassis and improve matters when the batteries are running down.

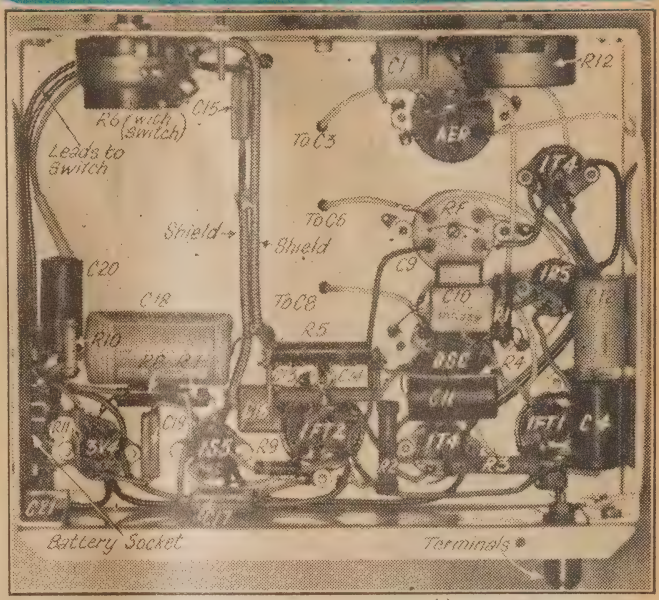
CHASSIS SIZE

In selecting the chassis layout and dimensions we had to keep in mind that it would normally be used in a console or mantel cabinet, with a fairly large dial movement. There was, therefore, no point in making the chassis too small while, on the other hand, the miniature valves would have looked rather out of place on a large chassis. As it is, the chassis measures 8in. x 6¼in. x 2¼in.

The central position is occupied by a small three-gang condenser of local manufacture operated by a USL44 dial—the same as specified for the "Fireside Five" receiver. We understand that the new vertical straight line dial is in the course of production, and this should be worthy of consideration.

The three tuning coils mount side by side behind the gang condenser, with the RF and converter valves at the righ-hand edge of the chassis. Along the rear of the chassis are the first IF transformer, the IF amplifier valve, the second IF transformer, the 1S5 detector/audio valve and the 3V4 output tube.

KEYED UNDERCHASSIS PICTURE



This coded underneath photograph gives a good idea of just where all the parts fit in. Note the battery and speaker socket is on the side of the chassis rather than at the back.

The aerial and earth terminals are on the rear of the chassis and the loudspeaker and battery plug are on the side handy to the batteries, should they be located inside the cabinet.

The coded underneath photograph shows clearly the layout of parts beneath the chassis. The volume control, with its associated "off-on" switch, is on the left, with a conventional treble-cut tone control on the right. We had planned originally to mount some of the wiring components on a resistor strip down the centre of the chassis, but they are so few in number that this form of mounting is unnecessary.

It will be noted that full-sized coils and IF transformers were used, since there appeared to be little point in using miniature components throughout.

TEST FILAMENT

The larger units give a somewhat better balance to the appearance of the set, and are certainly easier to work with. There is no reason, however, why miniature components should not be used with this circuit, and it could be made up into a very good portable.

When wiring the set it is wise to do the filament circuit first, interconnecting the positive filament pins of the valves. Note that pin-5 becomes the positive connection to the 3V4, pins 1 and 7 being connected to earth as filament-minus. Earth the filament-minus pins on all other sockets, and also the centre sleeve, which forms a partial shield between grid and plate. Put in the wiring to the switch and check the filament circuit by means of a torch globe and a couple of leads.

WIRING UP

You can then proceed with the rest of the wiring, but, before actually plugging the valves in, check it over very carefully and test the filament circuit once again with a torch globe.

Note that the aerial lead from coil to terminal is best taken outside the chassis to shield it from the IF channel. The loudspeaker output transformer can either be left on the speaker or mounted in the vacant space on the chassis alongside the gang condenser.

If the circuit components are of the correct value, all voltages should look after themselves, and there are no adjustments to be made to the chassis apart, of course, from those concerned with alignment. The alignment procedure is quite standard.

MAGNETIC storms which blanket out radio communications may now be predicted dependably to within 15 minutes, research engineers of the Radio Corporation of America announced last month.

The new accurate predictions are due to the discovery of a "critical zone" on the face of the sun. Sunspots in this area are the ones responsible for radio "blackouts." Composition and polarity of these spots are also factors that determine their effect on radio communications.

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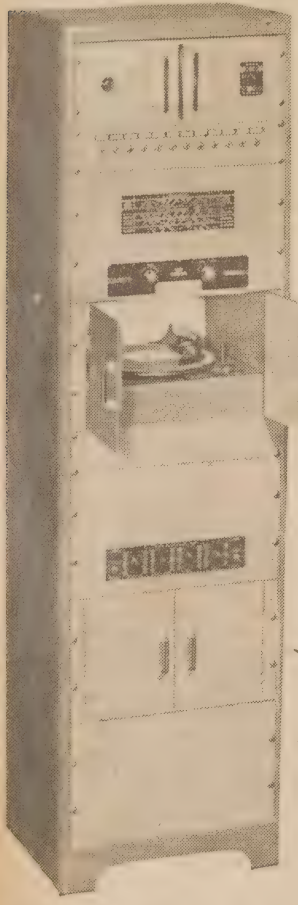

"SOUND" FACTS

No. 1 To check the balance of push-pull amplifiers, insert a 50 ohm wire-wound resistor in the centre tap or B plus lead of the output transformer. If the output of one valve is greater than the other, an AC voltage can be measured across the resistor. Adjusting the grid drive or the bias of one valve until no voltage is indicated will result in balanced output. In the absence of a meter or an oscilloscope, a pair of headphones connected across the resistor will do. If unbalance is present in the amplifier, an audio tone will be heard in the headphones. Balanced output will be indicated by adjusting as above until no tone is heard in the headphones.

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  provides simultaneous control of volume and tone of both microphone and radio or microphone and gramophone—a stand-by switch is also located here.
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  this compartment will stow 75 records, either 10" or 12".
- **EQUIPMENT RACK**
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VACUUM METALLURGY

(Continued from Page 17)

trate the pouring process. It will be seen that in this particular method the furnace tilts while the mould remains vertical, thus allowing the molten metal to pour from the crucible.

Metals treated by vacuum metallurgy have been found to be purer than the best commercial metal. Copper, for instance, has better density, better electrical properties and heat conductivity, and is more highly ductile.

As it is possible to melt metals in this way at a lower-than-normal melting point, there are further advantages, in that raising the temperature above the normal (vacuum) melting point will cause the metal to volatilise.

INCREASING TEMPERATURE

If, then, a metal is a mixture of metals of lower volatility, it is possible to carry out a distillation process by gradually increasing the temperature until all the unwanted metals are distilled off.

Thus calcium can be purified in this way. Copper can be freed from such impurities as selenium, and sulphur. Brass can be freed of zinc, and the copper content recovered. The possibilities are endless.

At present vacuum metallurgy is not carried out on as large a scale as ordinary furnace smelting, but with time the process will be very widely used.

The uses of the rarer metals has brought about another process which admits of working the metals without melting.

Tungsten wire is made in this way by reducing the oxide of tungsten powder to the tungsten metal, and packing it into the form of bars under great pressure. When this mass is heated electrically, the particles cohere, and the bar may then be specially hammred until it is of sufficient strength to be made into a forging or drawn into wire.

POWDER METALLURGY

This process, known as powder metallurgy, has several advantages. It is possible to make small articles direct from the powdered metal by compressing the powder in dies of the required shape and electrically heating to cause cohesion. The objects can be made very hard and solid, or be given any degree of compactness, according to the amount of pressure applied. They can be completely porous, if required.

Some types of bearings for engines are made from this spongy compressed metal, as the pores of the metal hold the oil and give a better lubrication than solid metal. Certain tools for high-speed work are made in this way, especially those made from very hard compounds of the carbides of tungsten, and titanium.

These compounds are so hard that they can be used in place of diamonds in many applications. They are very

MAXWELL'S RADIO

The Multi-Talkie A/C or Battery Personal Portable

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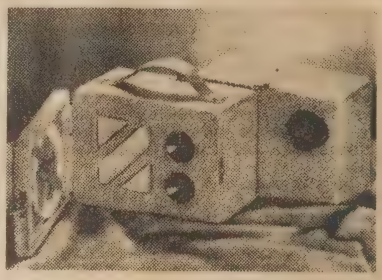

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Midget Osc. Coil "Q" Plus **4/9**
"Q" Plus Loop Aerial **6/11**
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Valves **20/6** each
Minimax 67½ **17/1**
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Complete £16/10/-

The Multi-Talkie Set **£13/5/-**
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Chassis **5/-**, Cabinet **18/6**, Power Transformer **18/-**, Midget Filter Choke **6/8**, 6X5GT **17/-**, 1000 ohms Res. **1/-**, 1650 ohms Res. **1/-**.

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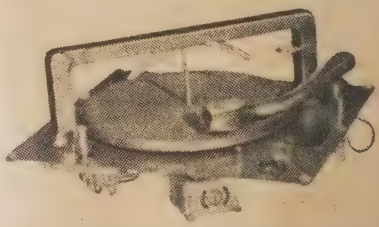

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brittle, but when crushed and mixed with a metal powder, and heated to bring about cohesion with some binding substance, they make excellent high-speed tools and dies. The metal powder usually employed is cobalt.

Among the light metals of aluminium and magnesium is another one—titanium. Up to quite recently the metal itself was little known, and was used mainly as a white chemical pigment for paint. Now, however, because of a new process, the metal is being made in fair quantities.

Hitherto, it was not possible to extract the pure metal by ordinary processes, as it oxidised too readily. By reduction of a compound of the metal known as titanium tetrachloride with pure molten magnesium, in the presence of the gas helium under pressure, the metal has been obtained.

USE OF PRESSURE

This process of using pressure as the direct opposite of vacuum metallurgy has many modern applications. It is possible to duplicate some of nature's work when various minerals were produced deep in the earth by pressure.

Talcum powder, for instance, which is composed of silica magnesia and water under nature's pressures, has been duplicated by exposing magnesium silicate to a high water vapor pressure.

Admittedly, this talc has only been produced in very small quantities, but it is something for the future.

In the production of ammonia and the hydrogenation of coal to make oil and petrol, very high pressures are used, and the apparatus calls for metals which will withstand very great stresses and heat.

It is in the new alloys, and the process of vacuum metallurgy, that make these high pressure apparatus practicable. The future is bright with possibilities for the engineering trades, with which is linked the welfare of the people, and much research work is constantly going on in all countries to bring about improvements in technique.

★ ★ ★

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NOW that the Ambassador continental airliner has completed more than 10 months' intensive test flying, the Airspeed Company has arrived at a finalised specification.

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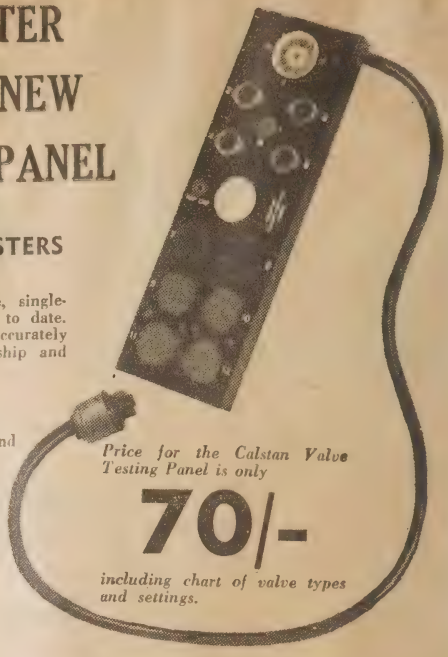

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Price for the Calstan Valve Testing Panel is only

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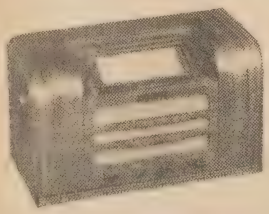

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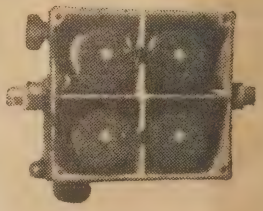

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FROM THE SERVICEMAN WHO TELLS

I am not sorry that I invited correspondence from readers of these columns. Many interesting letters have come to hand which give an insight into the trials and tribulations of fellow servicemen. Keep on writing but please don't forget to give due emphasis to the technical aspect—unusual faults and your method of tracing them, and what is just as important, failures and problems which you find to predominate in your district.

REVERSING the order of things, I will start off with a couple of my own observations, after which we can take time off to look through the mail.

On two or three occasions I have mentioned the effect on the gain of a pentode audio stage when the screen resistor becomes virtually open-circuited. The gain drops away to a very small figure, the distortion rises sharply, but the set does not become inoperative. Unless one is alive to the possibility, one can spend quite a lot of time wondering just why a particular set is less sensitive than it should be.

REDUCED GAIN

This month I had a variation of the trouble. A client complained that the gain in his receiver seemed to be well down—a point which may have passed unnoticed had he not been a keen short-wave listener. I may not have noticed anything much wrong, either, since the shortwave performance was a trifle down, but certainly not bad. Sufficient to say that I have heard a lot worse due, amongst other things, to improper design or alignment of the coils. On the broadcast band the set appeared to be satisfactory, and I only had the client's word for it that a deterioration had taken place.

At his request the set was taken back to the service shop for a thorough check over, and the first operation was to re-align the tuned circuits. Actually, the original factory alignment was quite in order, and no appreciable improvement was evident.

AUDIO SCREEN PIN

Still rather dubious of the complaint, I checked all valves, and then began to run the meter over the various sockets, to check the operating voltages. All went well till the meter prod was touched on to the screen pin of the pentode audio amplifier, and I detected a slight rise in the background noise. This was strange, since the optimum screen resistor gives maximum gain, and any variation in screen voltage, as when a meter is connected, should certainly not produce a rise in volume.

The next step was to check the resistor, but this was quite in order, approximating 1.5 megohms. A higher value and a lower value were tried but, strangely enough, without any increase in volume. Why should it happen then, with the meter prod on the lug?

Whether by impulse or intuition—I leave it to you—I reached for a 0.1 mfd. condenser, and bridged it between the screen pin and chassis. Up came the volume. There was already a condenser on the screen pin, so that obviously it was open-circuited, allowing an obscure form of negative feed-back to operate on the stage.

Quite a nasty one, I thought, since the condition would not be revealed by any measurement of voltage or current in the stage. It was just fortunate that the capacitance of the test lead had made enough difference in the gain for me to notice it. "It is the little things . . . ." they say.

ELECTROLYTIC CONDENSERS

Here's something simple for a change. A client brought in a receiver and explained that, although it played the stations okay, it suffered from a terrific "roar." Further, that it was the first trouble the receiver had given for many years.

The statement was quite significant to me as a serviceman, and so there was little doubt in my mind that the trouble was simply low capacitance electrolytic condensers.

Electrolytics differ from paper and mica condensers, in that the dielectric is a chemical film, and one pole is actually a chemical fluid or paste. Modern semi-dry electrolytics use a paste, whereas the older can types employed a fluid electrolyte. In either case, the electrolyte tends to dry out after a few years of service, and the condenser begins to lose capacitance. When this happens, the hum level rises, and the general performance of the receiver deteriorates.

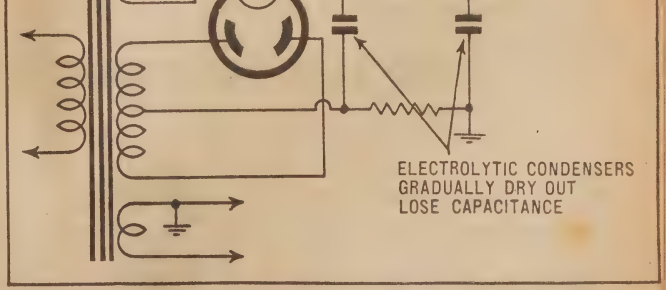
The hum is objectionable in itself, but the tone is also affected. The final filter condenser is actually part of the audio return circuit for the output valve, and, if the capacitance drops from 8 mfd. to, say, 1 mfd or less, the bass response falls away and the whole audio characteristic changes.

SIZE AND PRICE

Electrically, paper condensers are more reliable and efficient than electrolytics, but the latter are a fraction of the price and a fraction of the physical size. They are, therefore, employed universally in receivers, despite the fact that replacement is necessary after a few years' of service.

Physically, semi-dry electrolytics are quite different from the can types, but they serve the same purpose. The chief objection in some cases is that removal of the old condensers leaves two or three vacant holes in the chassis, and I usually make a point of explaining the reason for them to the set-owner. In some cases it is possible to leave the old condensers in position, but I usually remove them if they are discharging fluid and generally looking "messy."

This was the case in the particular set and I removed the old con-



A stock trouble in mains receivers is failure of the electrolytic condensers. They gradually lose capacitance, causing a loud hum in the speaker, with accompanying deterioration in the quality of reproduction.

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A limited quantity of these Superb Exponental Cone High Fidelity Loud Speaker units are available from stock.

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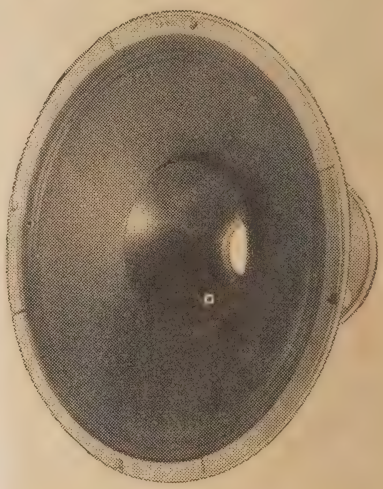
Total Flux: 145,000 Maxwells Fundamental
Resonance 55 cps Voice Coil Impedance 15 ohms
Overall Dia 12 5-16", Depth 6 9-16"
Weight 12lb.

* These Speakers are not suitable for use with poorly designed Equipment as their extended frequency range will disclose distortion products if present in the input signal.



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densers completely from the chassis and installed the tubular semi-dry types. The positive end of the condensers connect to the same point in the circuit as the original condensers, while the negative pigtails go to earth or to the back-bias circuit, as required. Needless to say, the hum cleared up and the set returned to a very satisfied client. No silence is quite so impressive as that which results from the removal of a heavy background hum.

HOME SERVICE!

Speaking of electrolytic condensers recalls an incident earlier in the month, involving someone who had tried to repair their own receiver.

It, too, had developed a serious hum and the owner correctly diagnosed it as being due to faulty electrolytic condensers. Appreciating the fact that they dry out and lose capacitance, he duly reasoned that the capacitance could be restored by replacing the lost fluid. Here his technical knowledge of the subject came to an end, for, without further ado, he mixed up a solution of common salt, made a small hole in the top of each can and "filled 'er up."

The cans were duly sealed and the set switched on. The hum had certainly stopped, but so also had everything else. The only complication appeared to be that the rectifier plates became very red. Naturally, because the liquid he had so carefully poured into each condenser can is an excellent conductor and had transformed the said components into two rather elaborate short-circuits.

THE DICTIONARY

Just to dispose of the matter, I looked up the subject of electrolytic condensers in a technical dictionary and read as follows:—

ELECTROLYTIC CONDENSER (Elec. Comm.): A condenser which is dependent on a thin film of aluminium oxide on the surface of aluminium foil for capacity, the other electrode being either a solution of non-corosive salt, or a thick paste containing same. The aluminium base must be maintained positive, otherwise released hydrogen removes the oxide film. See also ELECTROLYTIC CAPACITOR.

As for the electrolyte, it isn't ordinary table salt, as the definition might infer. Another textbook presented me with a list of possible chemical solutions, data on degrees of concentration and the voltages to which condensers using them could be manufactured.

It further explained that, during manufacture, the condenser must be "formed," a process which involves applying across it a high voltage at a current sufficient to form the oxide film. This is rather beyond the ratings of the humble 80! In other words, if electrolytic condensers fail, buy new ones from the shop; don't try to make them.

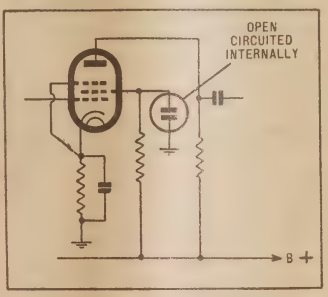
CORRESPONDENCE

Now for two or three of the letters which have come to hand. Commenting on the unfortunate habit of connecting 6-volt car batteries to 2-volt receivers, Mr. N. M. Perry, of Bulahdelah, top-scores with this anecdote:

"I was told the other day of a fellow who clipped a 6-volt car battery on to a set using five 2-volt valves, and immediately burned them out. He duly bought another set, took them home, and, as he sadly pulled out each dud valve, he replaced it carefully with a new one of the same type. Then he switched the set on and immediately burned them all out again. Yes, the 6-volt battery was still connected to the receiver."

After that, I guess, there would be an excuse for almost any behavior.

Mr. A. Woodham, of Narromine, NSW, was reminded by another reference of an experience dating back to 1923, or thereabouts. I am afraid yours truly wasn't worrying overmuch about radio then. The letters of the alphabet were more in my line in those days.



Loss of gain in a dual-wave receiver was traced to an open-circuited screen bypass resistor—a variation of the o/c resistor complaint.

However, a set was submitted for examination by an owner who claimed that he could hear the programmes quite clearly without having the speaker connected at all. Mr. Woodham could hear them, too, coming apparently out of the wooden box.

It turned out that the sounds were produced by loose transformer laminations, and the installation of a new transformer silenced the set and relieved the mind of the worried owner. "You'd be worried, too," says our correspondent, "if you could hear music that you shouldn't hear."

A letter from Mr. Moreton Johnson, of Leabrook, SA, needs only to be published, word for word. Mr. Johnson recalls two incidents in particular.

"The first was an AC mantel set, owned by a man who travelled over the same route every fortnight, selling tickets, &c., on a theatre circuit, which was based on this town. His set was out of action on his return from town "A," and he said it must have packed up at town "B" because, on connecting it up at town "A," it wouldn't play. I found an electrolytic condenser had broken down, and the rectifier ruined—quite an ordinary job.

MAINS VOLTAGE?

"Next time he came home from town "A" the same story was told, and the same repair found necessary. I might mention that the set had no dial lamps. At this stage I asked if the voltage at either town was high, although I was sure it wasn't, because I had visited both of them.

"The next time I went with him to town 'A' on other business, and watched my friend hook up his set; absently at first, and then with renewed interest, as I saw him remove the plug from the mains cord (there being no 3-pin outlet in his ticket office) and withdraw each of the two power fuses in order to twist the wires around the legs of them, as he had done before Suddenly light dawned on me, as I also observed a "neutral link" on the board, and suggested that he use one fuse and this link.

"You can guess the rest—everything was okay, and a test showed there was 415 volts between the fuses where the set had previously been connected.

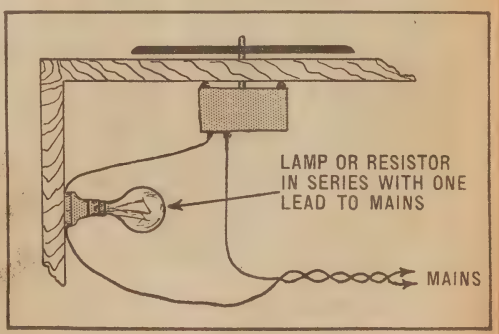
"The second incident was really non-technical, and concerned a battery set that had 'gone dead.' On arriving at the house I began checking up on the battery connections. Finding a piece of paper folded up between a couple of the tubes, I opened it, thinking it might be a diagram for the battery connections. But it was the broadcast listener's licence, and had expired a month before. I

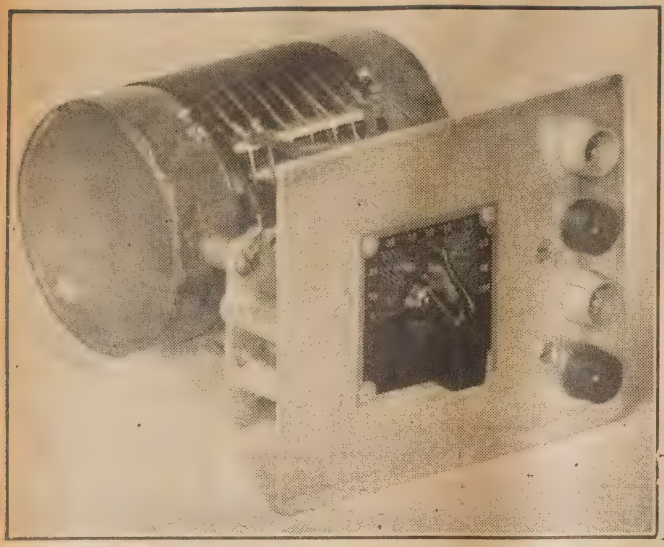
(Continued on Page 89)

☆

Rumble and hum in gramophone motors can often be minimised by reducing the operating voltage. A heavy duty resistor or a lamp in series with the mains will do the trick. A sluggish or badly lubricated motor may not run with reduced voltage, however.

☆

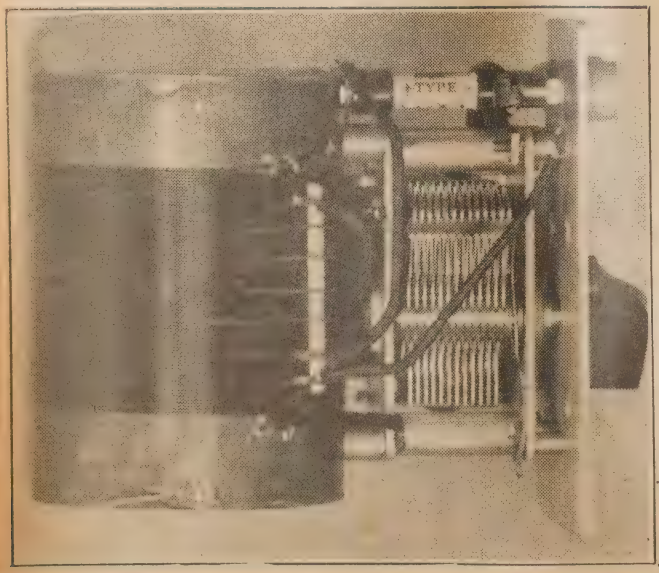




The coil, condenser, and panel are bolted together to form a single unit. This makes the set easy to handle and to house.

THE UNIT CRYSTAL SET

Here's a crystal set that isn't—a crystal set without a crystal. It's place in the circuit has been taken by a miniature copper-oxide rectifier, which needs no adjustment and produces signals substantially louder and clearer than most mineral detectors. Build up this little unit, attach an aerial and earth, and you can have your programmes virtually for nothing.



Left: A plan view of the set showing how the components are put together. Note also the tappings on the coil.

CRYSTAL SETS have had a good run during the past few months, with cricket broadcasts extending into the small hours of the morning. When there's no cricket there's always music to listen to, and it doesn't matter a hoot if you go to sleep in the middle of it. Your crystal won't overheat and there are no batteries to run down. It just goes on playing until the station goes off the air.

There's only one requirement—or, rather, two. You must arrange to live within 15 miles or so of a broadcast station and you must erect a good aerial and earth system. After that, you can leave matters to the crystal set.

Of course, if you live in a particularly favorable area farther out and erect an enormous, rather than just a big, aerial, a crystal set may still come good. But long range is not one of its strong points.

Basically, the circuit of this new set is the same as the "Crystal King," published a few months back. Just a coil and tuning condenser, with tappings for the aerial and detector circuits. One can make all kinds of fancy connections with additional windings and components, but in the majority of cases the simple circuit is as good as any.

From the constructional viewpoint, however, we built this set in different fashion, mounting the whole lot behind a small metal panel. You can pick it up as a unit—hence, the name, the "Unit" Crystal Set.

COIL IMPORTANCE

Electrically, the performance of a crystal set depends a great deal on the characteristics of the tuning coil and it is most important to achieve what is known technically as a high "Q" factor. A big solenoid coil is usually very good in this respect. In fact, the coil for the "Crystal King" was measured in an independent laboratory and found to have a "Q" of 170! This compares with about 100 for an ordinary litz-wound iron-cored broadcast coil.

At the present time, the wire most readily obtainable in Sydney is about 24 SWG gauge, enamelled, and we accordingly wound our coil with it, being a three-inch former.

You will need, therefore, about six

inches of three-inch diameter coil former, preferably of bakelised cardboard. Begin the winding about three-quarters of an inch from one end of the former, and wind on 80 turns, with a tapping at each 10th turn. The method of tapping used on this occasion is worthy of mention.

Take a couple of ordinary wooden matches, shave off the heads, and leave them ready to hand. Wind on the first nine turns and bring the wire round ready for the 10th turn. With a scrap of emery cloth, clean a short length of the wire in a line with the beginning of the winding, slip the tip of one match beneath the 10th turn, and continue winding.

When you come to the 20th turn, repeat the procedure, working the match along just enough so that it can be made to slip under the wire. Repeat at the 30th turn, the 40th, and so on.

When the winding is complete, you will have every 10th strand duly cleaned and raised above the contour of the coil. It is a simple matter to solder to these turns, and there is less danger of breaking than with the alternative method of twisting the wire into pigtails.

If you decide to use heavier gauge wire, the same number of turns can be wound on, but, of course, the coil will be more bulky. However, the heavier wire will be more efficient electrically.

When the winding is complete, trim off the excess amount of former, leaving about three-quarters of an inch for mounting purposes.

To mount the coil, obtain a couple of three-eighth inch spacers, and drill holes in the former to correspond with suitable holes in the back plate of the tuning condenser. Most modern types have a number of such holes available for mounting purposes. Attach the coil with a couple of small bolts.

PANEL SIZE

In the original set the condenser was mounted, in turn, on a small aluminium panel, which should be just slightly wider and taller than the condenser-coil assembly. This is to allow the set to slide conveniently into a box. The original panel happened to be 4¼ inches wide by 3½ inches high.

Cut the panel to the appropriate size and mark on it the positions for the condenser-mounting holes. You will probably need four more spacing bushes and four countersunk bolts for this purpose. Alternatively, the whole assembly can be mounted up on long 1/8in. bolts and spaced out as necessary by means of nuts.

Having determined the position for the condenser and spindle, an indicator plate can be riveted in place. Alternatively, you may decide to use a small dial, in which case the indicator plate will not be necessary.

CONNECTIONS

Connections for the aerial, earth and phones can be by means of terminals or banana plugs and sockets arranged in line down one side of the panel. The earth socket and one of the phone sockets can make direct contact with the metal panel, but the other two have to be insulated by means of washers and a scrap of sleeving. Either a piece of plastic "spaghetti" or rubber sleeving will do for this.

After this initial preparation, the job of assembly is simplicity itself.

Mount the condenser directly on to the metal panel, and this becomes the "earth" circuit of the set. The actual earth terminal or jack is mounted directly on the panel, so that no actual wiring to it is required. The same applies for the lower phone terminal. Had a bakelite panel been employed, it would have been necessary to run wires from each of these to the condenser frame; but, in our case, the metal panel provides the necessary connection.

The coil is already attached to the rear of the condenser, so that it only remains to make the necessary connections to it.

Join one end of the winding to the frame of the condenser and run a flexible lead tentatively from the aerial socket to the first tapping on the coil—that is, ten turns up from the earthed end. The top of the coil can be connected to the fixed plates of the tuning condenser.

THE DETECTOR

The detector itself is wired between the upper phone terminal and a tapping on the coil, which can be set tentatively at twenty turns from the earthed end. Rather than let the end of the detector float loosely around, the lug can be twisted, for anchoring purposes, through a hole in the end of the coil-former. Incidentally, the detector you ultimately buy may be smaller than the one pictured, but the characteristics are the same. It is known as "Westector" type WX-1.

Connect a .001 mfd. mica condenser across the phone terminals, and the set is complete.

To obtain the best results, it is essential to use a good outdoor aerial although, in a good location, you will be able to get by with an aerial under the rafters—provided your house has a tile roof. The earth wire

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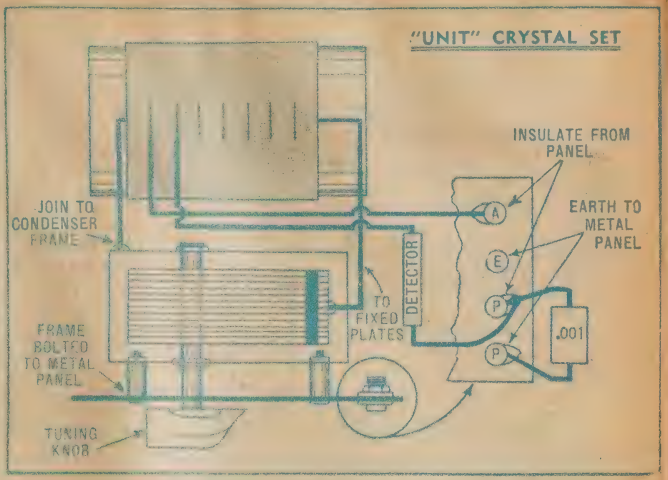
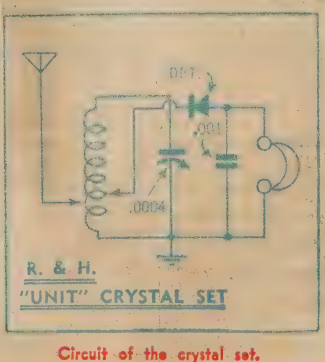


The wiring is particularly simple for the good reason that there is very little of it.

PARTS LIST

- 1 Aluminium panel (approx. 4¼in.x3½in.)
- 1 6-inch length of 3in. diameter coil former.
- Small quantity of 24 SWG gauge enamel wire, or heavier.
- 1 Tuning condenser (.0004 mfd. approx.).
- 1 Indicator plate with pointer knob.
- 1 Westector, type WX-1.
- 4 Banana plugs and sockets (or 4 terminals).
- 6 small spacing bushes, ⅛in. bolts and nuts, hookup wire, etc.



Circuit of the crystal set.

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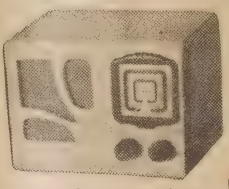

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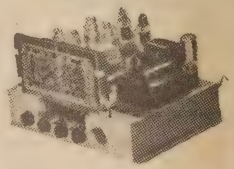
A very popular and easily built model. 4 valves, D/W. A.C. mantel set with A.V.C.

Little General 1947

B/C version of the 1946 Little General in same leather covered cabinet.

1947 Advance

Neat console kit features straight line dial, permag speaker. 5 valves, D/W. A.C.



1947 Senior Radiogram

High fidelity and power with push-pull 807 output are features of this 8 valve D/W A.C. receiver with R.F. stage.

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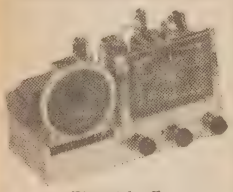

Fireside 5

5 valve D/W or B/C A.C. mantel receiver in two-toned leather cabinet.

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Uses all latest miniature components and is complete with leatherette cabinet, batteries, etc.

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Available as Foundation Kits or complete with valves and all components.

- KFT1—5 valve B/C A.C superhet. kit.
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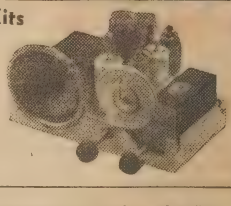

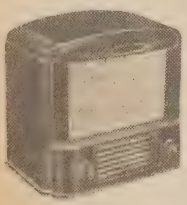

Electronic Parts Kits

In the famous Electronic Parts plastic cabinet (left) and complete with valves, speaker, full building instructions, etc.

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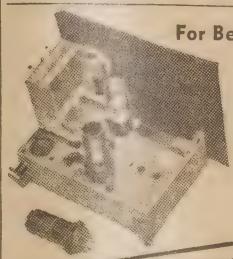
- 3 valve Triple Wave A.C. Kit.
- 4 valve Battery Kit.
- 4 valve B/C Vibrator Kit using Ferguson Vibrator Unit.



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Complete with all parts, including headphones, valves, batteries, complete building instructions, etc.

1946 Standard

7 valve D/W A.C. console with R.F. stage and push-pull output. Large straight line dial and 12" permag speaker.

You are invited to send for our free descriptive leaflet and price lists of these and other kits.

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KIT-SET SPECIALISTS

Getting Started On F.M.

The prospect of regular FM transmissions in Australia on a permanent basis still seems a long way off. The experimental transmitters, however, provide an opportunity to "get acquainted" with the new technique. This is an introduction to a series of FM articles which will explain in some detail the principles and practice you will want to know. The series will highlight the similarities and differences with AM as we know it today.

ALTHOUGH we have had experimental transmissions from frequency modulated stations in both Sydney and Melbourne for well over twelve months, very little interest has been taken in them by experimenters and home-builders. There are two reasons for this—lack of materials and lack of knowledge.

Maybe the first lack is largely the cause of the second. Maybe, too, the fact that most coil manufacturers are working on the design of coils suitable for FM makes the present a good time for us to do something about it. Because regular services on FM don't seem to be very much nearer is no reason why those of us who like building things shouldn't make up something to hear these experimental broadcasts, and get some idea of FM in action.

EVENTUAL SERVICES

It is pretty certain that eventually we will have FM services here in Australia. As a result, home-builders and service men will need to know something about it, both theoretically and practically. They might do well, therefore, to make use of the experimental services, which don't show any signs at all of closing down, to help them add to their knowledge and experience.

In the next few issues, we intend to publish some articles on FM purely from the experimenters' angle.

This month, discussion will be of a general nature, our purpose being to establish some line of comparison between AM and FM so that their similarities and differences may be best appreciated.

The newcomer to FM will undoubtedly find some difficulty in "getting the hang" of the principles involved. Mental pictures of waveforms and detection methods won't mean very much if applied directly from AM to FM.

However, let's start from the beginning, and see just how simply we can introduce the subject. If we can do that in this article, then, in subsequent issues we can take the various sections of the receiver, analyse them in more detail, and set out more fully just how and why they operate.

In the first place, you will at least know from the name that FM works by varying the frequency of the carrier, and not its power, as with an amplitude modulated singal.

In AM transmitters, the louder the sound being transmitted, the greater are the variations in carrier power. On full modulation, the carrier actually increases four times on modulation peaks, while on the opposite or negative swing of the modulating wave-form, the power is reduced almost to zero. In this condition, the signal is modulated 100 per cent, and any louder signals would merely cause distortion.

CONSTANT CARRIER

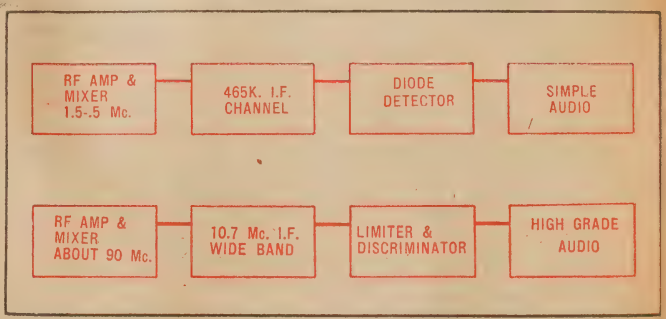
But with a frequency modulated signal, there is no variation in carrier power at all. Until music or speech is heard, the station sends out a carrier on its assigned frequency, just as with an AM station. But as soon as a signal is transmitted, the frequency of the station swings from side to side of this original "mid-point." The louder the signal, the further the frequency is swung, or deviated, from its silent point.

The speed at which the frequency deviation takes place depends on the audio frequency, or band of frequencies being transmitted. If, for instance, a single tone of 1000 cycles per second was transmitted, as might be done for testing purposes, the signal would swing either side of its mid position 1000 times per second. When music is being transmitted, the signal is, of course, made up of many frequencies in the musical scale, and the speed of the frequency swing or deviation is therefore much more complex than with a single tone.

DEVIATION

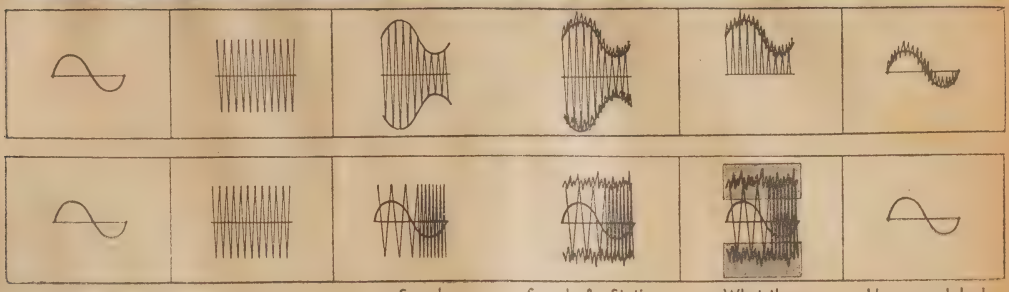
The important points to realise from this brief explanation are firstly that, in frequency modulation, the station's frequency is swung, wobbled or deviated backwards and forwards across its unmodulated position, the amount of swing depending on the loudness of the signal. Secondly, that the rate at which the frequency is so deviated depends on the audio frequency or frequencies being transmitted.

This frequency swing of the FM stations means that two or more of them must be spaced well apart if interference is to be avoided. So far apart, as a matter of fact, that there would be room for only very few (about seven) such stations, if they occupied the normal broadcast band. They need a band-width of anything up to 150 kc, as against about 10 kc for an AM station. For this reason, it was decided early in the piece to move FM stations right down to the lower wave lengths where there are an enormous number of unused frequencies available. In Australia, the FM stations operate on about 3½ metres, a fre-



These block diagrams show how the various sections of an AM and an FM set correspond.

HOW F.M. REDUCES ELECTRICAL INTERFERENCE



F.M. limiter and discriminator (lower diagram) makes set insensitive to most electrical noise.

quency of about 90 megacycles per second.

So much for the initial picture of FM. We do not need to delve any deeper for the moment to understand how and why receivers will differ from those for AM.

A radio receiver can be divided into a block diagram of several units. Firstly, there is the RF amplifier and converter section, assuming the universal superhet. circuit is used. Next comes the intermediate amplifier channel, then the second detector or demodulator, and finally, the audio amplifier. Let us consider all these in turn.

RF AMP. AND MIXER

The RF amplifier and mixer circuit do not look very much different from the AM set, except that, because of the much higher signal frequency used, the coils will have only a few turns of small diameter heavy gauge wire, and the tuning condensers only a few, tiny plates. After all, this is only what you might expect. The valves, too, are generally of a specialised type, small in size to keep electrodes, capacities, &c., small to match. Ordinary valves and components would be useless on these frequencies.

The coupling between stages, and probably the mixer-oscillator circuit, won't be exactly the same as with the AM set. Usually a separate oscillator is used in the mixer circuit, as of course was done in the days before pentagrid mixer valves. The pentagrid system isn't very successful on the new band—the noise level associated with it is far too high. "Tuned anode" coupling, too, is frequently used, but again this was used first in AM circuits. There is nothing much so far which is unfamiliar either in circuit of in technique.

The first radical change in these things is found in the IF channel, and for a very simple reason. In an AM set, the selectivity curve of the IF channel is made only broad enough to accommodate about 10 kc at the top (generally less than this) to avoid cutting sidebands, and then drops off sharply so that nearby stations can be tuned out.

BANDWIDTH

Such an IF system would be quite useless for FM. Remember that the frequency is liable to swing over a total band-width of 150 kc? Obviously, therefore, our IF channel must cater now, not for a mere 10 kc, as with AM, but 150 kc, or 15 times as wide.

There is another point about the IF amplifier we might as well mention here. On the broadcast band, 465 kc is a very nice intermediate frequency, and spaces the oscillator tuning well away from the signal frequency to avoid oscillator "pulling" and double-spotting. The average set-builder knows the importance of both these things. But when, instead of the band of .5 to 1.5 megacycles, we move down to about 90 megacycles, 465 kc. become only a tiny fraction of the signal frequency. Both pulling and double-spotting, to mention only two items, would be very bad if we tried to use it. Moreover, the task of obtaining the required wide-band characteristic would be nearly impossible.

INTERMEDIATE FREQUENCY

The general practice, therefore, is to choose an IF which is a substantial fraction of the signal circuit. The accepted frequency is 10.7 megacycles. The separation is now sufficient to avoid serious double-spotting, and as most tuned circuits at this frequency are rather broadly tuned in the first place, it isn't nearly as hard to obtain a sufficiently wide selectivity curve in the IF circuits to cater for the FM carrier swing of 150 kc.

In practice, this result is generally obtained by using either transformers or the "tuned anode" circuit. The coils are made with as high a "Q" as possible, and then damped down in selectivity by the use of loading resistors across them. At this stage, it is sufficient to record that, by such methods, the IF channel is given suitable characteristics. In a later article, we will be able to analyse more fully this and other details.

Because the gain per stage of such a channel is not nearly as high as with a standard IF of 465 kc., at least three stages are generally used in an FM set. To get the flat-topped, sharp-skirt selectivity curve, as many as five tuned circuits may be needed. This is one reason why FM sets generally have a large number of valves.

So far we have progressed through the RF stages, mixer, and IF amplifier without meeting any new types of circuit. When we reach the second detector, as we know it, things begin to happen. As we are not handling amplitude modulation, and, in fact, desire for several reasons to make the set incapable of responding to amplitude modulation, a new approach is required. Much electrical noise is of the amplitude-modulated character, of course, which is one reason we don't want our set to respond to it.

DEMODULATOR

The function of the second detector or demodulator of an AM set is to produce an audio component from a carrier which is varying in amplitude. In the FM receiver, a circuit must be used which produces audio when the signal fed to it varies in frequency. That is the obvious and main difference between the two.

At a later date, we will talk about some of the most-used circuits in some detail, as it is rather hard to explain how they operate in a few words. We can, however, visualise a tuned circuit, the two sides of which are fed to a pair of independent diodes, for instance, and balanced so that variations in amplitude, being fed equally to both halves of the balanced circuit, are cancelled out, and do not produce any output.

When the carrier frequency is varied, however, as it is when the FM station is modulated, the circuit is no longer balanced — the degree of unbalance being a direct function of the swing or frequency deviation. This unbalance sets up audio voltages across the load circuit, and these voltages are fed to the audio amplifier, which, from then on, is pretty much the same as in an AM receiver.

Some of these second detector circuits are preceded by one or more valves known as limiters. Their main purpose is to hold the amplitude of the carrier as received from the IF

(Continued on Page 89)

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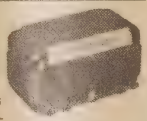

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FOR THE JUNIOR EXPERIMENTER

LET'S TALK ABOUT COMPONENTS—TRANSFORMERS

So far, most of our component discussion has dealt with the tuning end of the receiver. This month, we transfer attehtion to the audio section and examine a rather important coupling device—the audio transformer. Although not used today as freely as it was once, the transformer is still valuable in radio circuits, particularly for small receivers.

AT the outset it may be as well to study a little circuitry and a time-honored two valve triode arrangement will serve admirably. It comes originally from the July, 1942, issue and can be adapted to suit almost any triode valves on hand. The only points to watch are that the filament voltage is correct and likewise the grid bias for the output valve. However, our purpose at this juncture is not to discuss the whole circuit but to confine attention to the audio transformer and its functions.

An audio transformer consists basically of a primary winding having many thousands of turns of fine wire, a secondary with generally a greater number of turns and an iron core. Both primary and secondary may be simple multiple-layer windings or they may be sectionalised to provide the maximum amount of magnetic coupling between them. For special purposes they may also be individually centre-tapped.

The physical shape varies widely with different manufacture, while the price may range from a few shillings to a few pounds. But more of this anon.

CIRCUIT USE

Referring to the diagram it will be noted that the plate circuit of the detector is connected to one end of the primary winding, the other end of the winding going to B-plus. In most cases the d-c resistance of the primary winding amounts to only about 1000 ohms, so that there is no great loss of voltage across it. In other words, the voltage effective at the plate is substantially the same as the supply voltage.

This is an important point, particularly in the case of a detector valve. The very nature of a grid-leak detector is such that it operates with zero initial bias. The application of a high plate voltage under these conditions would mean excessive plate current in many cases, leading to wastage of battery power, damage to the valve and possible damage to the transformer. For this reason, transformer-coupled grid-leak detectors generally operate with no more than 45 volts as the plate supply.

With resistance coupling on the other hand, there is inevitably a large d-c drop across the resistor, so that the detector plate voltage is substantially less than the supply. Thus no damage is likely to be done if the resistor is returned direct to a much higher potential than normal.

When the detector plate current varies at an audio rate with incoming signal it causes a variation in the magnetic field surrounding the transformer core. This varying field, in turn, induces a current in the secondary winding and produces a corresponding signal voltage across the winding. This is applied to the grid of the following valve.

INDUCTANCE

In actual operation, therefore, the important property is not so much the exact d-c resistance of the two windings but their inductance, which is a function of the number of turns and the properties of the laminated iron core. Thus a primary winding with a d-c resistance of say, 1000 ohms, will present an apparent load at audio frequency of many thousands of ohms—due to its inductance. This property of inductance, by the way, is exactly the same as already explained in connection with tuning coils. In this case, however, many thousands of turns are involved and the inductance will amount to several "henries" rather than so many "millihenries" or "microhenries." But perhaps we are becoming a little too technical.

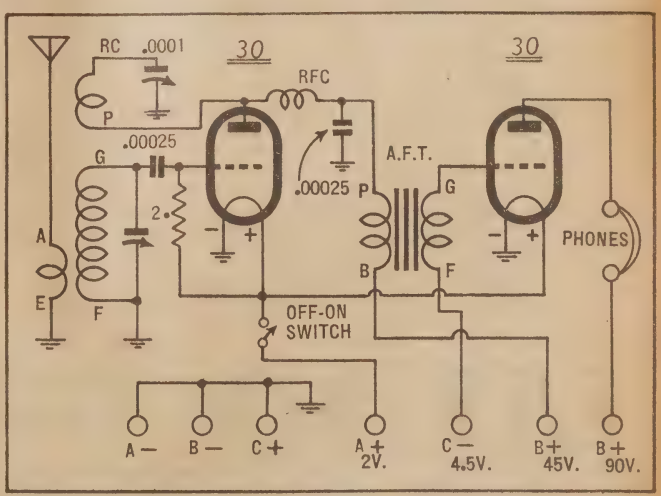
The ratio of signal voltage across the secondary to that developed across the primary corresponds almost exactly to the ratio of turns. A conventional audio transformer is quoted as "3½: 1" which indicates that there are three and one-half times as many turns on the secondary as on the primary. The transformer thus contributes a voltage gain of 3½ times, which is additional to the gain provided by the valves. A few transformers are marked 5: 1, indicating a step up ratio of five times, secondary to primary.

A rather obvious question which arises from this statement is simply "Why limit the ratio to five? Why not make the ratio ten times or fifty times and realise that amount of gain?" An explanation at this point is certainly warranted.

To ensure good frequency response, the primary winding must have a certain minimum amount of inductance which, in the ultimate, boils down to winding on a certain minimum number of turns. A transformer wound with fewer primary turns will have very poor bass response and cause the reproduction to sound very "thin."

SELF-CAPACITY

On the secondary side, the limiting factor is the amount of capacitance which builds up from one turn to the next, and from one layer to the next, right throughout the winding. The capacitance effect increases with turns and sets an ultimate limit beyond which the reproduction becomes dull, due to lack of treble. These two factors, working in conflict thus set a limit to both primary and secondary turns and therefore to the ratio which can be achieved between them. In practice, it is difficult to achieve



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a step-up of more than 3: 1 in a standard transformer and still maintain reasonable frequency response and ease of manufacture.

The characteristics of transformers—and the price—have varied widely over the past 20 or 30 years. In the early stages of radio development, audio transformers, like most other components, were new items of manufacture and their cost was high. At the same time there was little thought of fidelity over and above that necessary to achieve intelligible speech. Experience naturally made possible the production of transformers of better characteristics at a cheaper price but, apart from one or two special cases, the frequency characteristics of transformers manufactured before about 1930 were very poor by modern standards. This seems a long while ago, but there are nevertheless many transformers in the hands of experimenters dating back this far.

COST v. QUALITY

Nowadays the price of an audio transformer is still very largely a guide to merit, so far as characteristics are concerned, since good transformers are necessarily more expensive to design and manufacture. The only advice which can be given is simply to purchase the best you can afford.

On the other hand, the limit to fidelity in a small receiver may be set by the use of earphones or a loudspeaker of obsolete design. In such a case it is rather futile to spend a dis-proportionate sum on a super-quality audio transformer.

Now a word about the connection into circuit. Transformers of Australian or American manufacture are normally coded with the letters "P (plate)," "B (B-plus)," "G (grid)," "F (earth or bias)". This coding is more or less self explanatory and can be compared with the coding on the typical circuit.

Transformers of English or Continental manufacture are often branded "IP, OP, IS and OS," indicating respectively inside primary, outside primary, inside secondary and outside secondary. Conventionally "IP" would connect to plate, "OP" to B-plus, "OS" to grid and "IS" to earth or bias.

CONNECTIONS

It seldom matters, really, which way round you connect the primary and secondary windings. The set would still operate if plate is connected to "B' 'and "B-plus" to "P." Likewise for the secondary. All that happens is that the signal voltage on the following valve may be reversed in phase which of course normally makes no difference to the sound in the loudspeaker or phones.

However, the phase of the signal in some circuits will have a bearing on stability, due to random coupling through the wiring or the power supply. Thus, reversing the connections one winding on a particular transformer may prevent or pro-

(Continued on Page 57)

"S" METER CIRCUITS FOR AMATEURS

An "S" meter is not an essential feature of an amateur receiver but it is very handy nevertheless. More accurate reports of signal strength are possible and the effects of fading and transmitter adjustments are readily noted.

IN its simplest form an "S" meter consists purely of a milliameter connected in the cathode circuit of one of the AVC controlled stages. With no signal input, the valve draws a certain current which diminishes with signal according to the amount of AVC bias developed.

A typical IF amplifier valve draws a cathode current of about 10 milliamps at full gain, diminishing to between 4 and 5 milliamps with a strong input signal. Experience may show that an "S4" signal swings the meter back to, say, 8.0 milliamps, an "S7" signal to 6 milliamps, and so on. The region below 5 milliamps would be the sanctum of "S9-plus" signals. The exact deflection depends, of course, on the initial sensitivity of the receiver and the number of stages to which AVC is applied.

Since the cathode type "S" meter relies for its deflection on a change in cathode current, it is desirable that the particular amplifier valve be operated initially under full gain conditions. The cathode can then be expected to swing from 10 milliamps back to about 4 milliamps with signal, thereby utilising approximately two-thirds of the meter scale. If, on the other hand, the valve is initially overbiased, the plate current may not vary more than a couple of milliamps with signal.

STAGE GAIN

In a receiver with one IF amplifier stage, the valve is normally operated at full gain, but conditions are different where a two-stage IF channel is employed. For the sake of the "S" meter reading, it is wise in this case to operate the first valve at very low initial gain, allowing the second valve to operate at full gain. In this way the overall gain of the IF channel is kept within reasonable limits, but the metered valve operates over the full range of its characteristic.

In the "Communications Nine" it was possible to operate both IF amplifier valves at full initial gain, due to the higher coupling losses of the back-to-back IF transformer arrangement.

A 10 milliamp meter is an obvious choice for the circuit, but a 5 milliamp or a 1 milliamp movement can be used provided it is suitably shunted. In most cases the shunt resistor works out at about 10 ohms. Actually there is no need for the meter to read exactly 10 milliamps full scale, and it can be shunted back to the requirements of the particular amplifier, reading full scale with zero input signal. It could, of course, be connected in the plate circuit of the valve, but the cathode circuit connection is generally to be preferred.

One disadvantage of the circuit is that signal strength readings are spread over little more than half the meter scale. The situation can be improved by passing an initial "bucking" current through the meter in the reverse direction to the cathode current. The meter than reads only the variation in plate current and, if a more sensitive movement is employed, this will occupy the entire scale. It is not difficult, at the same time, to make the circuit into a forward reading type, thereby overcoming the psychological objection of having the meter read backwards.

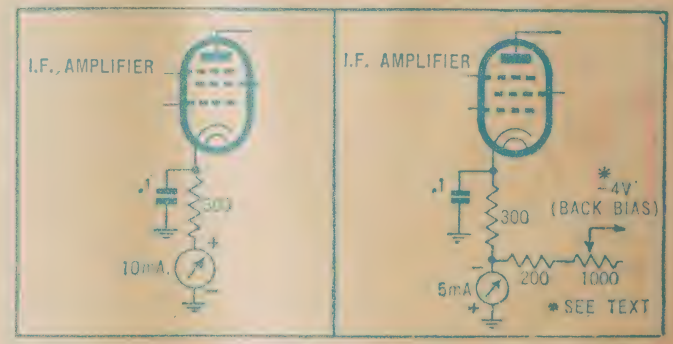
"Bucking" circuits can be arranged in a variety of ways, but they all introduce a fairly critical adjustment and are likely to subject the meter movement to reverse current and to occasional overload. It is therefore necessary to make sure that the circuit ultimately used offers sufficient protection to the movement during adjustment and use. A suitable arrangement is shown in circuit 2.

The meter movement is connected in reverse polarity in the cathode circuit, the cathode current tending to move the pointer backwards. However, a second circuit leads current from the back-bias network through the meter in such a way that it tends to read forward, the two currents tending to cancel in their effect on the pointer.

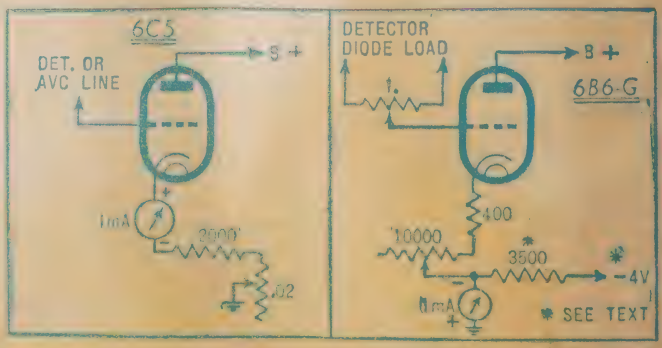
CIRCUIT ADJUSTMENT

In practice, the receiver control is set for maximum IF gain and the aerial terminals shorted. The potentiometer in the bucking circuit is then adjusted till the pointer reads exactly zero. As signals are tuned the valve cathode current diminishes and the meter reads forward according to the strength of the incoming signal. Since the change in plate current approximates 5 milliamps, a meter having this sensitivity is necessary if full advantage of the circuit is to be taken. It is possible, of course, to use a 1 milliamp movement, suitably shunt-

Continued on Page 67



Circuit 1 shows the simplest form of "S" meter and circuit 2 a modification of it which expands the scale and makes it forward reading.



Two circuits which require an additional valve. The special feature of 4 is that "S" points are read directly from the scale of a 0-1 milliamp movement.

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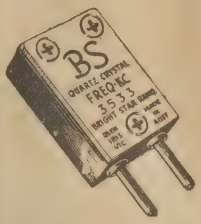

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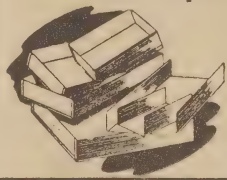

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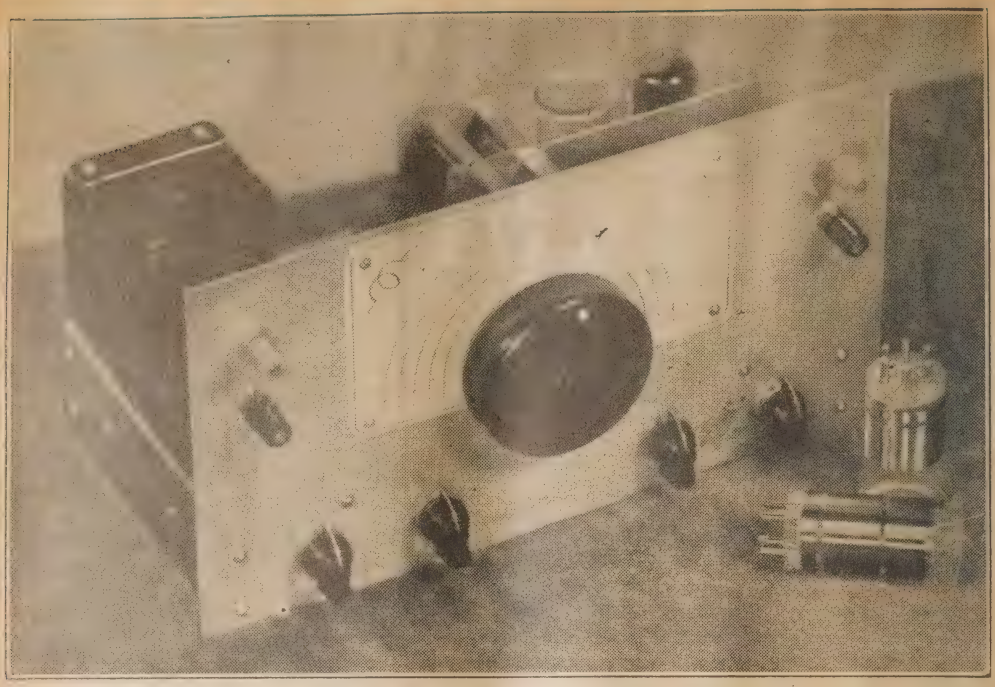


Controls, left to right, are audio volume, regeneration, RF trimmer, and R.F. gain. Terminals at left are for phones—speaker terminals at the rear. The broadcast coils are also shown. Looks good, doesn't it?

AN ALL BAND T.R.F. SET

Here is a splendid utility set for home constructors, short wave listeners, and amateurs. It is simple, easy and cheap to build, and has full coverage from the broadcast band down to 30 megacycles. We believe it will become the standard "simple set" for many a day.

THE basic design is as old as short-wave listening itself—tuned R.F. stage, regenerative detector, audio system and a set of plug-in coils. Our older readers will well remember the sets of this type and, in fact, there are plenty of amateurs who, even now, prefer them for C.W. listening.

Yet, casting our minds back, we could not recollect a single such design in Radio & Hobbies. The last one must have been back in the old Wireless Weekly days. So out came the aluminium, the coil formers and the other necessary bits and pieces. As the little set took shape, we began to generate a very real interest in it.

First the broadcast coils. We went through the whole painful process of putting turns on and pulling them off again, getting the primaries and the reaction winding just right. After that, we coupled the set to the signal generator and there it was—audio coming out of the speaker with less than 2 microvolts of signal going in at the front end! Last time we tried a set of this type there hadn't been a signal generator within a dozen miles. No wonder we were able to tune signals on it.

REACTION SMOOTH

Then we wound up the 14Mc coils and much the same thing happened. Of course, the reaction control has to be adjusted right "on the nose" to achieve these figures but it is completely smooth in operation. There is simply no "backlash" in its operation.

After that we took the receiver out to a quiet suburban location and checked right over the frequency range. On the broadcast band, all the locals were received on the loudspeaker, plus a few of the strong interstate stations. Out in the country, with a big outdoor aerial, there would be little doubt about results.

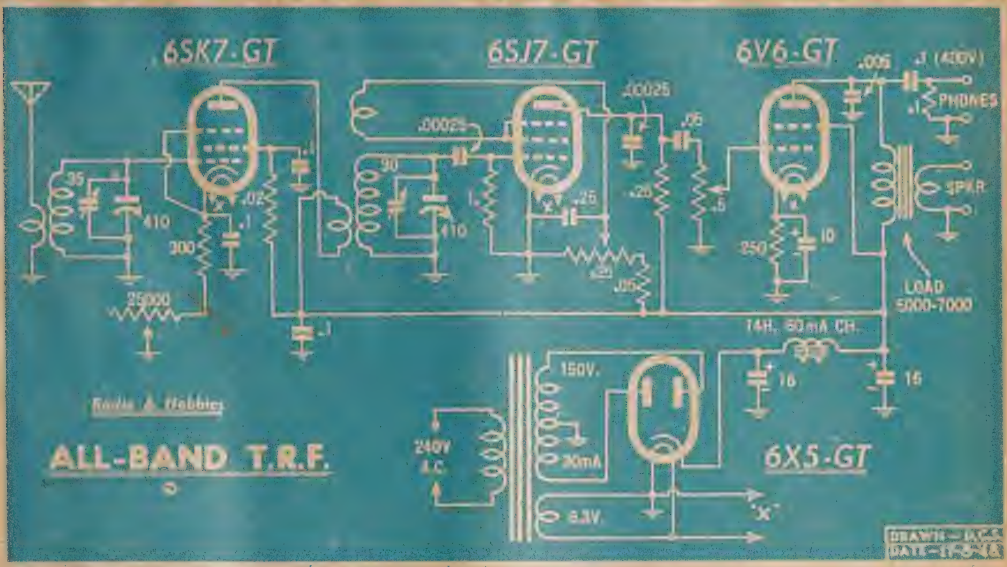
On the short-wave bands, and still using the picture rail aerial, we could tune in plenty of overseas stations plus morse signals by the hundred. The amateurs were well in evidence on both phones and loudspeaker.

Of course, the set has no "S" meter and no A.V.C. The selectivity is limited and the reaction control calls for careful handling. But you can receive plenty of signals, for all that, and you can do it with four valves and a set of home wound coils.

The receiver was built on a chassis measuring 6in. x 11 in. x 2in. which is fitted with a front panel measuring 6¾in. x 12in.

For the R.F. amplifier we suggest a 6SK7-GT, although any ordinary variable-mu R.F. pentode will do equally well. They all operate with much the same bias and screen volt-

CIRCUIT DIAGRAM OF ALL-BAND T.R.F. SET



The circuit is an old reliable brought up to date. Note that the detector suppressor is connected to the screen.

age so that, in the ordinary way, no circuit changes are required. However, the screen resistor is calculated on the basis of a 180 volt high tension supply and it would be necessary to increase it to about 70,000 ohms if for any reason, the high tension supply were increased to 250 volts.

The aerial coil and R.F. amplifier valve are located at the front right-hand corner of the chassis, handy to the aerial terminal on the front panel. Two panel controls are associated with this stage, one a manual gain control and the other a variable trimmer across the coil. In practice this trimmer is used to peak the aerial circuit on the different bands and it eliminates most of the problems which would be associated with fixed trimmers.

NEW CIRCUIT

The detector is also a pentode, operated with the now familiar screen grid reaction. There is one important modification however, in that the suppressor is tied to screen. Thus connected, the detector will oscillate reliably down to 30 Mc. at least.

We have specified the single-ended 6SJ7-GT for the detector socket but any ordinary R.F. pentode would do, preferably a sharp cut-off type. The screen potentiometer gives complete control over regeneration, almost irrespective of the valve type, but keen experimenters may like to experiment with the number of turns on the reaction winding. Varying the reaction turns necessitates operating the screen at a different potentail and this has an effect on detector gain. However we spent a lot of time over the coils and you should find our data very close to the mark. Another point is that we have specified a 0.25 meg. plate load whereas, with some valves, rather better results may be achieved with a 0.1 meg. plate load.

Still another point concerns high gain valves, like the 6AC7, EF50 or VR65, which some readers may desire to use. Our experience has been that such valves are very hard to stabilise in a regenerative set and results are achieved more simply in most cases by using valves with more moderate characteristics. Another point is that valves with an internal suppressor/cathode connection may not be a proposition for frequencies as high as 30mc.

The detector and its associated coil is mounted behind the RF stage and a fairly lengthy lead is required therefore to the screen potentiometer. This is purely a d-c circuit, however, and there is no danger of interaction. Had condenser reaction been employed, it would have been necessary to set the condenser back closer to the detector circuit and operated by means of an extension shaft.

AIR TRIMMER

Note that a small air trimmer is connected permanently across the detector tuned circuit. The purpose of this is to add capacitance to the circuit so that, for tracking purposes, the aerial circuit can be adjusted to have slightly more or slightly less capacitance. More about the coils in a moment.

PARTS LIST

- 1 Chassis 11in. x 6in. x 2in.
- 1 Front panel 12in. x 6½in.
- 1 Shield, 4in. x 3in. with ½in. flange.
- 1 2-gang tuning condenser (.0004 mfd.)
- 1 Vernier tuning dial to suit.
- 1 35 pf. midget condenser.
- 1 30 pf. air-trimmer condenser.
- 4 Octal sockets.
- 2 6-pin sockets
- 4 Pointer knobs.
- 1 5000 ohm output transformer.
- 1 30 mA. filter choke.
- 1 150/0/150 volt 30mA. 6.3V 2A. power transformer.
- Nuts and bolts, insulated pillars, screened wire, hook-up wire, etc.

VALVES

6SK7-GT, 6SJ7-GT, 6V6-GT, 6X5-GT.

CONDENSERS

- 2 16 mfd. electrolytics 350v. or higher.
- 1 10mfd. 40v. electrolytic.
- 1 .25 mfd. (200V) tubular.
- 4 .1 mfd. (200V) tubular.
- 1 .1 mfd. (400V) tubular.
- 1 .05 mfd. (200V) tubular.
- 1 .005 mfd. mica.
- 2 .00025 mfd. mica.

RESISTORS

- 1 1 meg.
- 1 .25 meg.
- 1 .1 meg.
- 1 .05 meg.
- 1 20,000 ohm.
- 1 300 ohm
- 1 250 ohm. W.W.
- 1 .5 meg. potentiometer.
- 1 .25 meg. potentiometer.
- 1 25,000 ohm. potentiometer.

TRANSFORMER RANGE *by* FERGUSON

This list of FERGUSON TRANSFORMERS represents our standard range which we are at present supplying the Radio trade.

This is by no means our complete range when taking into account those Transformers being supplied to manufacturers' special requirements.

Transformers of this type cannot possibly be listed in the space available and manufacturers are requested to contact us direct regarding their special Transformer requirements.

STANDARD RANGE TYPES

OUTPUT TRANSFORMERS

TYPE	PRIMARY	SECONDARY	RATING
OP1	5000 and 2500 ohms S.E.	12.5, 8.0 & 2.3 ohms Voice Coil	10W
OP1A	5000 and 2500 ohms S.E.	500 ohm Line	10W
OP2	5000 ohms P-P	12.5, 8.0 & 2.3 ohms Voice Coil	15W
OP3	6600 ohms P-P	12.5, 8.0 & 2.3 ohms Voice Coil	15W
OP4	10,000 ohms P-P	12.5, 8.0 & 2.3 ohms Voice Coil	15W
OP5	5000, 6600, 10,000 ohms P-P	12.5, 8.0 & 2.3 ohms Voice Coil	15W
OP6	5000 ohms P-P	500, 250 and 125 ohms	15W
OP7	6600 ohms P-P	500, 250 and 125 ohms	15W
OP8	10,000 ohms P-P	500, 250 and 125 ohms	15W
OP9	5000, 6600, 10,000 ohms P-P	500, 250 and 125 ohms	15W
OP10	5000 ohms P-P	500, 250 and 125 ohms	25W
OP11	6600 ohms P-P	500, 250 and 125 ohms	25W
OP12	10,000 ohms P-P	500, 250 and 125 ohms	25W
OP13	5000, 6600, 10,000 ohms P-P	500, 250 and 125 ohms	25W
OP14	5000 ohms P-P.	500, 250 and 125 ohms	32W
OP15	6600 ohms P-P	500, 250 and 125 ohms	32W
OP16	10,000 ohms P-P	500, 250 and 125 ohms	32W
OP17	5000, 6600, 10,000 ohms P-P	500, 250 and 125 ohms	32W

TYPE	PRIMARY	SECONDARY	RATING
OP18	3800 ohms P-P	500, 250 and 125 ohms	60W
OP19A	5000 ohms P-P (30-10,000 C/s)	12.5, 8.0, 2.3 ohms Voice Coil	15W
OP19B	5000 ohms P-P (30-10,000 C/s)	500, 250 and 125 ohms	15W
OP20	11,600, 8400 ohms P-P (P.A. Range)	500, 250, 166 & 125 ohms	150W
OP21	8000 ohms P-P (30-15,000 C/s)	500/125 ohms	15W
OP22	3250 ohms S.E. 85 M.A. (30-15,000 C/s)	2.3 or 500/125 ohms	10W
OP23	3250 ohms S.E. 85 M.A. (30-15,000 C/s)	12.5 or 8.4/2.1 ohms	10W
OP25	10,000 ohms P-P (20-30,000 C/s)	Any Two Impedances in 4 to 1 ratio e.g. OP25 500/125. OP25 8.4/2.1 OP25 10/2.5	15W
OP8M	10,000 ohms P-P	500 ohm Line 10 Tappings	15W
OP15M	6600 ohms P-P	500 ohm Line 10 Tappings	32W
LJ	500 ohms	12.5, 8.0, 2.3 ohms	10W
U1	30,000, 20,000, 14,000 10,000, 7000, 5000 2500 ohms P-P-R	2.3 ohms Voice Coil S.E.Universal Speakers.	10W

CLASS B DRIVER AND INTERSTATE TRANSFORMERS

			Prim to ½ Sec. RATIO
1P1	Single 6J7G Triode 5 M.A. D.C. Unbalance	Class A1, AB1, P.P. Grids	1
1P2	Single 6V6G Triode 40 M.A. D.C. Unbalance	Class AB2 P.P. Grids 807, etc.	2.5
1P3	P.P. Class A, A1 Triodes 45's, 2A3's etc.	Class B P.P. Grids 809, B20B, etc.	2. 3 or 4
1P4	S.E. or P.P. Triodes	Class B P.P. Grids 809, B30B, etc.	2.8 or 2.15

MODULATION TRANSFORMERS

M25	6000 & 8000 ohms P-P	10,000, 7000, 5000 ohms, 100 M.H.	25W
M50	3800, 6600, 8000 ohms P-P	10,000, 7500, 6500, 5500, 4500, 3500 ohms 150M.A.	50W
M50M	Multi Primary	Multi Secondary	50W
M125M	Multi Primary	Multi Secondary	125W

VIBRATOR TRANSFORMERS

C30/25	30 Henries at 10V A.C. 100 C/s + 25 M.A. D.C.	6V/250	6V at 3.4A D.C.
C12/200	12 Henries at 10V A.C. 100 C/s + 200 M.A. D.C.	6V/240U	6V at 3.9A D.C. or 240V A.C.
			250V at 60 M.A.
			250V at 60 M.A. 6.3V at 2A (A.C.), using 6X5GT Non Sync. Operation.

POWER TRANSFORMERS

P30	240V A.C.	150V/150V at 30 M.A. 6.3V at 2A.

FILTER CHOKES

C30/25 30 Henries at 10V A.C. 100C/s + 25 M.A. D.C.
C12/200 12 Henries at 10V A.C. 100 C/s + 200 M.A. D.C.

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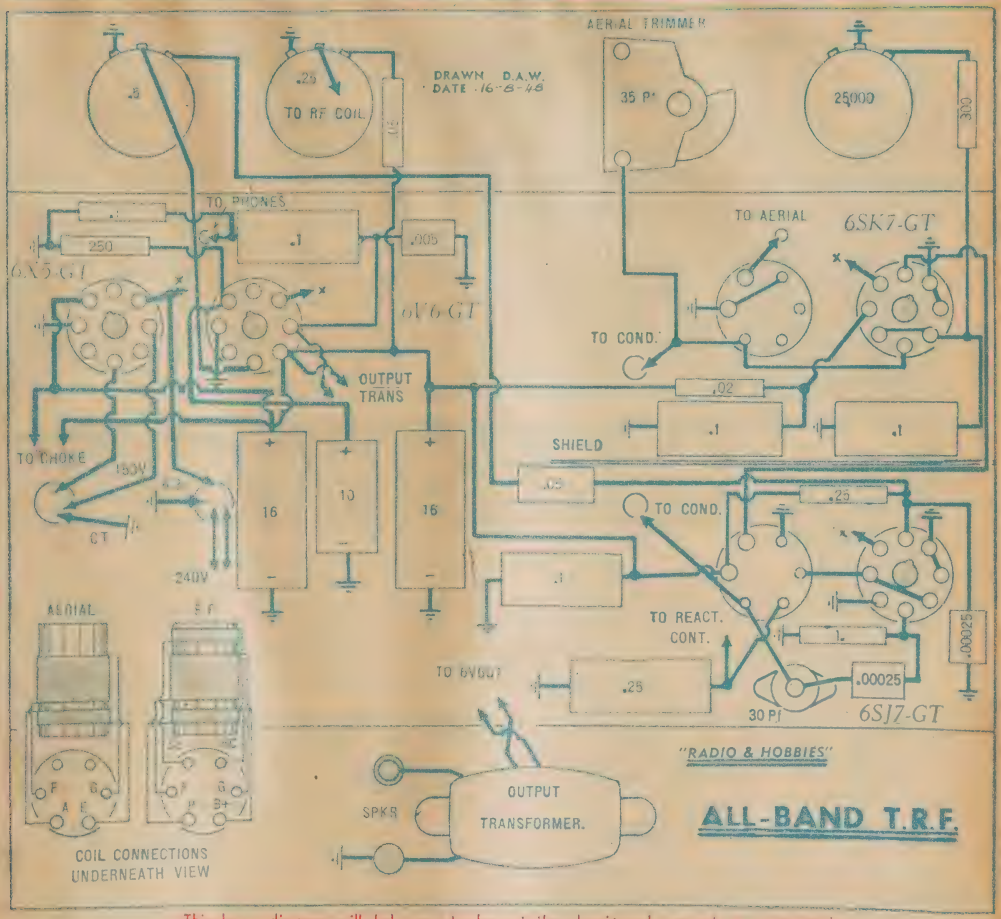
WIRING DIAGRAM OF ALL-BAND T.R.F.



This large diagram will help you to lay out the chassis and connect up components.

The output from the detector feeds through a conventional audio gain control to the grid circuit of a 6V6-GT output valve with terminals for either phones or loudspeaker. The output transformer should preferably be removed from the loudspeaker and mounted on the chassis so that, for phone listening, it serves as an output choke.

POWER SUPPLY

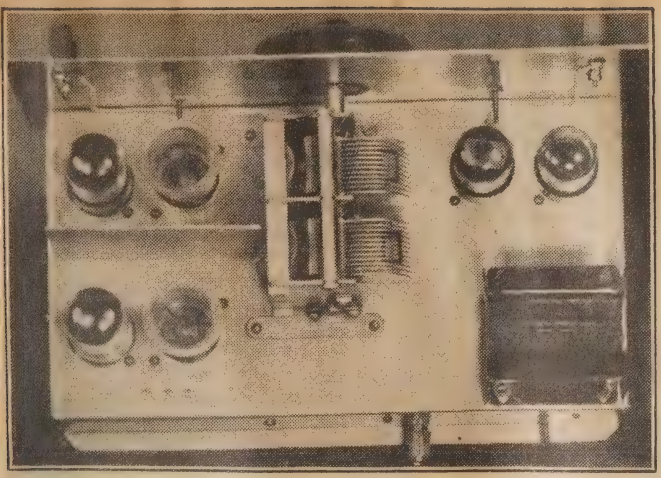
For the power supply we have used once again the handy little "Minivox" transformer, a 6X5-GT rectifier and a single midget filter choke. Note that the filter condensers are specified as 16 mfd, the purpose being to minimise hum when listening on the earphones. The hum level will thus depend very largely on the merit of the filter choke used and, if difficulty is experienced on this score, it may be wise to add another choke and condenser to the filter section. An additional miniature choke will fit quite easily on top of the chassis behind the gang condenser.

The condenser, by the way, is a standard broadcast "H" gang and the dial is an instrument type which is now available on the market. It is necessary to prepare a card scale for this dial but this can be quite a feature if the job is done carefully. However, there is no reason why another dial movement should not be employed, provided the action is completely smooth.

FULL COVERAGE

In designing this set we intended that it should provide complete frequency coverage which means, in turn, that a full-size tuning gang is required. The use of midget condensers, apart from mechanical difficulties, would have rendered the set very inconvenient on the broadcast band.

However, in winding the coils we have arranged matters so that the bands extend downwards from 28, 14, 7 and 3.5 megacycles. Then, of course, there is the set of coils for the broadcast band itself. This means that a good deal of overlap occurs and there is one more set of coils than is strictly necessary. However, amateur bands are tuned with a favorable l/c ratio and, if necessary, the coil data could be applied to a straight-out short-wave design. In other words you can use a condenser of about 250 pf capacitance and get a 2:1 coverage with greater band spread than with an "H" gang or, going a step further, it would be possible to use something like a 50 or 100 pf tuning gang and confine coverage to the immediate vicinity of the amateur bands. The set would become virtually useless on the



A plain shield isolates the R.F. (front) and detector (rear) sections of the set. A standard broadcast gang is used. The detector trimmer adjustment is seen behind the detector section.

broadcast band but this may or may not be a matter for concern.

There is a special point of interest in regard to the coils. Checking back over past issues and referring to commercial coils, we could find no semblance of standardisation in connections. With this new design on our hands we went into the matter most carefully and evolved a set of 6-pin base connections which we intend to use for all similar receivers until further notice. Coil manufacturers have been acquainted of this move and it is just possible that some of them may bring out commercial coils to suit.

As it stands, the coil data for hand winding is tabulated in the usual way and should present no particular difficulty to the average home builder. We have kept the wire requirements as simple as possible and a slight variation in gauge should have no drastic effect upon results.

Six-pin formers are more or less standard these days and the data calls for a diameter of 1¼ inches. It would

COIL DATA

Band	PRIMARIES	SECONDARIES	REACTION (on RF coil only)
Broadcast	Aer. 15T, RF 25T 32 B&S En. spaced ⅛in. from E earthed end of secondary.	110T 32 B&S En. close wound.	65T 32 B&S En. Spaced ⅛in. from Grid end of secondary.
1.5-4 Mc.	Aer. 11T, RF 15T 32 B&S En. spaced ⅛in. from earthed end of secondary.	35T, 24 B&S En. close wound.	26T 32 B&S En. Spaced ⅛in. from Grid end of secondary.
3-8 Mc.	Aer. 6T, RF 12T 32 B&S En. spaced 3/32in. from earthed end of secondary.	12½T, 24 B&S En. close wound.	15T 32 B&S En. Spaced 3/32in. from Grid end of secondary.
6-16 Mc.	Aer. 3T, RF 6T 32 B&S En. spaced ⅛in. from earthed end of secondary.	7T, 24 B&S En. spaced to occupy ⅜in.	8T 32 B&S En. Spaced 3/32in. from Grid end of secondary.
13-33 Mc.	Aer. 1T, RF 2T 32 B&S En. 1 turn below secondary. 1 turn interwound with secondary.	3T 19 B&S En. spaced to occupy ⅜in.	3T, 24 B&S En. spaced to 3/32in. from grid end of secondary.

All Formers 1¼in. Dia. 6 Pin.

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CORRECT TESTING PREVENTS FAULTS

AVO MODEL "7" UNIVERSAL

Multi-range A.C.-D.C. 50 ranges. Indication on 5" hand-calibrated scale. Range selection is by two switches for A.C. and D.C. respectively — press-button gives additional range for each value of current and voltage shown on the switch knobs. An automatic overload cut-out is fitted to protect the instrument against misuse. The wide range, the type of measurement covered and small power consumption make this meter suitable for radio Testing and General Engineering. Accuracy is within B.S. first-grade limits.

Fine adjustment and correct testing call for the use of precision measuring instruments. The Avometer range is famous for fine precision and the ability to withstand rough usage without variation in fine limits of electrical measurement.

Compact and portable, AVO gives the widest range of precision application possible and therefore represents the economical instrument buy to mechanic and engineer alike. AVO is worthy of your fullest investigation.

INTERSTATE REPRESENTATIVES:

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- A. E. Supplies Ltd., 431 High Street, Prahran, S1. Melbourne.
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- Newton McLaren Ltd., Leigh Street, Adelaide.
- Carlyle & Co., 915-917 Hay Street, Perth.
- Electronic Supplies Ltd., 94 Liverpool Street, Hobart.

SOLE AUSTRALIAN REPRESENTATIVES:

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HERBERT ST., ST. LEONARDS. N.S.W. P.O. BOX 29. CROW'S NEST. TEL: XF 1042

be possible to use 1in. or 1¼in. formers, but a proportionate increase or decrease would be necessary in the number of turns. The shortwave coils could well be wound on old valve bases in the interests of economy.

Compared with data given in earlier issues, there are obvious differences in frequency coverage and in the proportion of primary and reaction turns. The new specifications apply particularly to this receiver, whereas much of the earlier data was given as a basis for experiment and for lower gain valves than the6SJ7-GT. Note also that the connections to the R.F. primary are reversed.

Even as it is, there may be need to modify the windings slightly to obtain peak performance. Wiring methods and choice of components affects circuit capacitance and, in turn, the exact band coverage. The effect of reaction turns on gain has already been mentioned. It is necessary, too, for the detector and R.F. coils to track reasonably well. If you find that the signal is loudest with the aerial trimmer condenser full in, it may be necessary to add a turn or two to the aerial grid winding. Alternatively, the trimmer may peak when full out, in which case a couple of turns may have to come off. The trimmer on the detector circuit will normally be set to half capacitance.

The most troublesome coils are likely to be the 30 Mc. pair, and some experimenting may be necessary to obtain good performance. Not only is it important to keep leads short but the valve is operating at a frequency which has long been accepted as the practical limit for a regenerative detector.

After that, the performance will depend a good deal on the type of aerial used. In the suburbs, quite a small aerial will be adequate for the broadcast band. If you have a large aerial, the aerial coil primary can be pruned down until you get maximum selectivity and just enough gain from the weakest station. The aerial can be shortened electrically, on the other hand, by wiring a small condenser in series with the lead-in.

A large aerial is advisable for the shortwave listening and, for amateur band work, a resonant antenna is the best choice.

No Call Signs Changed

WHEN referring to the proposed slight changes in frequencies of some broadcast stations, one daily paper wrote "call-signs" for "frequencies," and as a result we have had one or two queries.

There is rarely any need to change station call signs, and every reason why they should be preserved. The frequency changes, we understand, were suggested after consultation with the New Zealand broadcasting authorities, to avoid the danger of mutual interference from high-powered stations in both countries. Such changes are only to be expected as more stations come on the air, but it is always a matter of policy

Junior Experimenter

(Continued from Page 45)

uce howling in the output, or motor-boating" effects.

Although we have confined our emarks to the coupling between the etector and following valve, trans-ormer coupling may similarly be mployed between this second valve nd the output stage, the method of onnection remaining unaltered. There is a limit, however, to the umber of stages one can operate at udio frequency and, in practice, rouble will usually follow any in-rease in audio gain beyond that rovided by a triode detector and wo transformer-coupled triodes fol-owing.

You will note that we have re-erred consistently to triodes and ransformer coupling and there is very definite reason for so doing. A triode has relatively low plate mpedance and operates well into the nductive load provided by a trans-ormer primary. With a pentode, he plate resistance is much higher nd there is a tendency for a pen-ode-transformer combination to roduce a signal deficient both in the ass and the treble register. Broadly peaking, it is preferable always to se resistance coupling with pentode alves. In terms of gain, a resist-nce-coupled pentode is at least as ood as, and generally better than, triode with transformer coupling.

NTER-STAGE COUPLING

The beginner is normally interested n transformers intended to couple he stages of a small regenerative et. This is loosely referred to as inter-stage transformers" or "class A" transformers and, as previously nentioned, normally have a step-up atio of about 3:1.

Certain circuits, however, utilise utput valve operating under Class AB2 or Class B conditions, where he grid circuit actually draws ower from the driving source. For uccessful operation, a Class AB2 or Class B stage must have a trans-ormer coupled-input circuit with a ransformer of special design. The pecial feature design windings of educed d-c resistance and a turns atio which is normally in the icinity of 1:1. That is to say, the econdary usually has about the ame number of turns as the primary. One or both windings may be centre-apped, according to the requirements f the circuit. While a class B ransformer is necessary in its own pecialised application, it is not the est choice for normal inter-stage oupling. Compared with a conven-ional class A transformer, one would xpect a difference in gain of 2 or to 1.

The original basic structure of the ncient Pons Aelius, a bridge erected n Rome by the Romans in AD134, till stands. Only minor repairs have een carried out since its construc-ion.

Here's your answer, Tom!

During the month we received a letter from a reader. We will just call him Tom, because that is his name. His questions were so wide in character as to leave us somewhat staggered. But, we reasoned, if Tom is puzzled on such a scale, so must be many others. So—here's your answer, Tom! Some of it must wait until next month, but we hope this first instalment will hold you until then.

TOM'S first question reads:—

"What is the full meaning of amps, watts, volts and ohms? In home lighting sets, for instance, an outfit may be described as '32 volts, 300 watts,' or '32 volts, 1500 watts.' In each case, the number of 2-volt accumulators is the same (16). What is it that makes the distinction?"

Well, there is quite a lot to this question, and, in the normal way, we cannot hope to answer it, either through the columns or by post. Most textbooks use up a couple of chapters in explaining these basic electrical units. We haven't anything like that amount of space to

spare, but it should be possible to give you an idea of what it's all about.

First of all, the "volt" is the basic unit of electrical pressure or electromotive force (EMF). A single dry cell exerts an electrical pressure of about 1½ volts, while one cell of a lead-acid accumulator exerts a pressure—or EMF—of about 2 volts. Three such cells connected in series provide your car with a 6-volt electrical system, or, if it happens to be an English make, it may have a 6-cell accumulator and a 12-volt system. On the other hand, the EMF in the power mains is likely to be 240 volts and sufficient to be dangerous to anyone who makes inadvertent contact with the wires.

But we are digressing. The important point to grasp is that the "volt" is a basic unit of electrical pressure.

THE AMPERE

The "amp" (short for "ampere") is another basic unit. It refers to the flow of electrical current. To take a simple analogy, one can connect a garden hose and a fire hose to the same water main. The pressure in each hose is the same, but the larger one obviously carries a greater flow of water. In just the same way, one can speak of electrical pressure (described as so many volts) and electrical flow or current (described as so many amps).

The "watt" indicates the quantity of electricity involved in a circuit, or an electrical device, and the figure is obtained mathematically by multiplying volts by amps. To return to the water analgy, the quantity of water is dependent on both pressure and flow. The same applies to an electrical circuit, except that we speak of watts per hour, rather than gallons per hour.

Any factor which tends to restrict the flow of electricity in a circuit is defined as the electrical "resistance," and the unit of resistance is the "ohm." Mathematically, the resistance in ohms is equal to the pressure in volts divided by the current in amps.

To refer these definitions to the second part of Tom's question, we note that he mentioned specifically a home lighting set rated at "32 volts, 300 watts."

First of all, the fact that it is a 32-volt system indicates that it involves 16 accumulator cells, all connected in series. It does not matter electrically whether these are entirely separate cells or whether they

are assembled as two or more composite batteries. The rating "300 watts" indicates that the system has been designed to handle that much power at its maximum electrical "load." It would mean that the maximum current flow permitted would be just under 10 amps. Obviously, 32 volts multiplied by 10 amps would equal 320 watts.

There is actually no need for the moment to worry much about the amps involved, as one can consider the suitability of the lighting set purely by the voltage rating. Such a set could operate simultaneously ten 30-watt globes or five 60-watt globes. Or, again, it could supply eight 30-watt globes simultaneously and have 60 watts to spare for a radio receiver. More globes could, of course, be connected to the system, but the electrical load at any time must not exceed 300 watts.

POWER RATING

In the second instance, Tom mentions a lighting set rated at "32 volts, 1500 watts." In this case the maximum current (watts divided by volts) would be just under 50 amps, and it would be reasonable to assume that the cells would be physically larger, likewise the generator and charging engine. One could load a system of this type with no less than fifty 30-watt globes or a variety of lights and household appliances to a total of 1500 watts. Nearly all globes and appliances are stamped with the voltage at which they operate and the power in watts which they consume. In this case they would all be 32-volt types.

Now for the second question:—

"Would 12 volt, 42 amp, or 12 volt, 100 amp, charging generators be suitable in lighting sets?"

Yes, Tom, you could quite well use generators of this type in a home lighting set. The idea would be to obtain preferably two 6-volt accumulators, with a high ampere-hour rating, and connect them in series to operate a 12-volt home lighting circuit. You could then use the batteries pretty freely to light 12-volt lamps and operate either of the generators as necessary to keep the batteries charged. When setting up such a system, obtain from the battery-makers the maximum continuous load current and the maximum charging current which they recommend. A suitable ammeter should be installed to ensure that these ratings are not exceeded.

Question 3: "Would the 12-volt batteries sometimes appearing in advertisements inserted in Radio & Hobbies be suitable in lighting sets? How far could the wires be run from the batteries without serious loss of current?"

Well, Tom, we cannot answer the first part of this question very well or, rather, we prefer not to. In the first place, we haven't paid special attention to references in advertisements to accumulators, nor are we experts in the subject. We try to see that only reputable firms advertise in the journal, and we will not tolerate malpractice if it is brought to our

(Continued on Page 69)

DISPOSALS EQUIPMENT

EXTENSION SPEAKERS

5-inch Per-mag speaker in an attractive black crystalised finished cabinet with chrome fittings.
Complete with on/off switch and lead.
Ideal for use with intercommunication systems.
Connects in series with the voice coil of your existing speaker.

39/6
Postage 2/6 extra.

Transmitting Condensers

30 Plate, high grade insulation ball bearing shaft support.
Shaft diameter ¼ inch. Length excluding shaft 3½ inch.

10/- Postage 1/- extra

26 Pin Plug and Socket

Suitable for all types of equipment, 2 large pins provided for heavy current. All contacts silver-plated.

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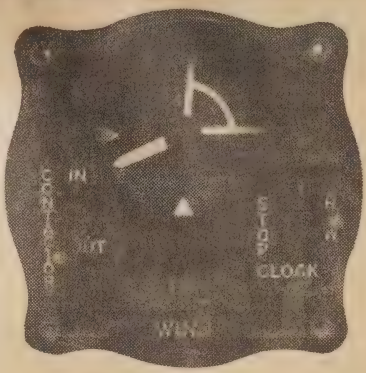
Postage 1/- extra.



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48 hour jewelled movement suitable for repetition timing over periods of one minute. Ideal for photographic work, electric sign switching, etc.

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Postage 2/- extra.

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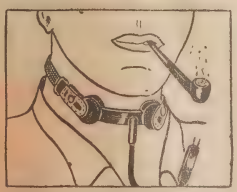
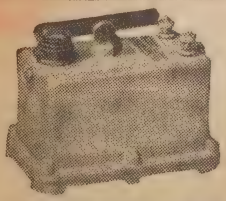


THROAT MICROPHONES
Twin-unit allows complete freedom of both hands. Very sensitive, with connecting plug and cable.
Postage 6d extra. FROM **7/6**

METAL CLAD SUPPRESSOR CONDENSERS
for noise elimination in Cars, Motors, and all Electrical interference with mounting lug and wire.
Post 3d. EACH **1/-**

BOX ASSORTED RADIO TELEPHONE PARTS
useful for Home Construction.
Post Free **10/-**



DYNAMO EXPLODERS
New, contain excellent generator and brass gears. In aluminium case.
Weight 13lb.
EACH, F.D.R. **29/6**

AR14 RAAF RADIO SETS, NEW

All Wave using Plug-in Coils. Uses two 45 Volt and one 1½ Volt dry battery—

4 Valves—Types 1P5, 1D8G, 1J6G—

By Purchasing a Reinartz Coil and placing in Aerial Socket in Set all Broadcasting Stations can be brought in—for other bands we can supply Coil Formers, 2/6 each.

The Set is equipped with 2 Coil Formers but No Valves—Price with 2 Coils £3 F.O.R.

The Original AR14 Army Packing Case Wood Metal bound, can be supplied for 3/6 extra.

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NEW VALVES
IN ORIGINAL
CARTONS
9/6
Post 6d.

VIBRATORS
A.W.A. FS6 Type. 6 Volt Synchronous Octal Base.
EACH **10/-**

MIDGET SPEAKERS
2in. diam. 1in. deep. Very sensitive floating diaphragm type, these can also be used as microphones. No Batteries NEEDED.
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With 50 mill copper oxide rectifier relay, 3.8v. lamp and socket, 2 phone jacks.
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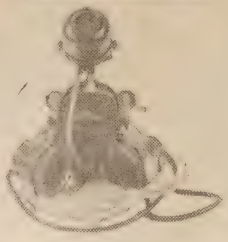

The set as illustrated consists of pair balance armature magnetic headphones and microphone, with cords and control switch — no batteries required. Ideal for conversion to simple house telephone. **22/6**

Postage 1/6 extra.

MAGNETIC UNIT

As used in the above sets make very sensitive microphones.

7/6

Postage 3d extra.

HEADPHONES

DYNAMIC (as illust.) 90 ohms impedance. Complete with headband and cord. **15/6**

Postage 1/6 extra.

MAGNETIC Standard low resistance type, complete with headband and cord. **7/6**

Postage 1/- extra.

EAR PIECES. Best quality Navy type. 300 ohms impedance **1/9**

Postage 3d extra.

DYNAMIC EARPIECES, as used in the phones illustrated. 45 ohms impedance. **6/-**

Postage 6d. extra.

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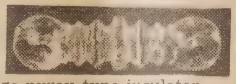

Large pyrex type insulator, 7" long. Postage 1/- extra. **2/6**

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Navy type (as illust.) heavy duty solid brass—on wood base, special contacts. **5/-**

Postage 1/- extra.

Army No. 8 type Key nickel plated on bakelite base.
Postage 9d extra. **3/6**

PHONE ADAPTOR

An American unit for converting low resistance phones to a higher resistance. Standard jack and plug fitting. **5/-**

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Lucas Daylight Signal Lamps (12 volt) complete with case, morse key, filters, and three spare bulbs. **17/6**
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Dynamic microphone inserts. Build up your own quality microphone.
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Switches—wafer type—3 bank, 4 pole, two position.
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Thermo Amp. Meters.—Your last opportunity to purchase a brand new 1 Amp. R.F. Meter at a fraction of the original price.
Postage 9d extra. **20/-**

Heavy duty twin microphone cable, 10yd. coil only.
Postage 2/- extra. **7/6**

Westinghouse ½ wave rectifiers, type MU4.
Postage 1½d extra. **2/-**

All goods on this page are ex-disposals and guaranteed NEW.

Selenium ½ wave rectifiers, 12 volt at 50 mA.
Postage 1½d extra. **2/-**

Navy Couble Button Carbon Microphones. Complete with switch and cord.
Postage 6d extra. **5/-**

Telephone Relay Panels, with 48v. 100 mA rectifier. Sensitive relay, etc. Postage 1/- extra. **5/-**

25,000 ohm midget potentiometer with standard shaft.
Postage 1½d extra. **1/6**

Spare Globes for Aldis Lamps, 12 volt only.
Packing & Postage 6d extra. . . **1/-**

5000 ohm 55 watt resistors.
Postage 3d extra. **1/6**

Heavy duty connectors for Amplifier, etc. Consist of chassis socket & plug, 2-4 or 6 conductor. . . . **5/-**

12 or 24 conductor. **7/6**
Postage 9d extra.

Block type Condensers, 2mf. 200 volt working.
Postage 3½d extra. . . . . **6d.**

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C.O.D. ORDERS 20% DEPOSIT

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HOW TO USE YOUR OSCILLOSCOPE

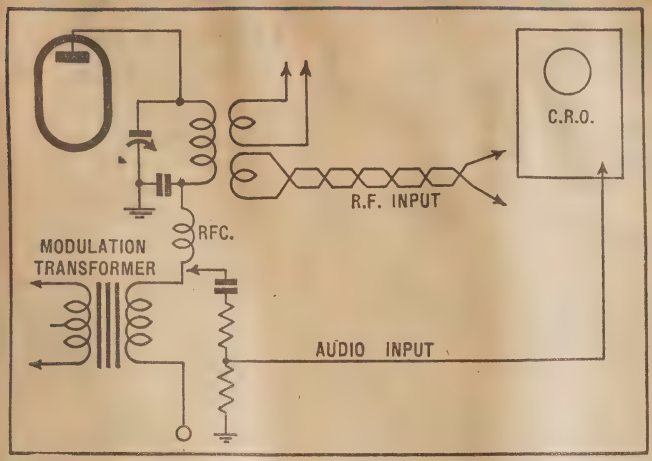


Figure 1. Illustrating the connections necessary between transmitter and C.R.O. for the trapezoid and modulated envelope patterns.

A cathode ray oscillograph is an invaluable asset in an amateur station, particularly if serious attention is given to modulation and its associated problems. This article explains how tests are carried out and the significance of various screen patterns.

PART TWO

IN the first place, all the tests outlined last month in relation to receivers and amplifiers apply with equal force to modulators. Provided that a suitable tone source is available, it is possible to determine the gain and the performance of individual stages, their distortion content and their tendency to overload.

The overload characteristic of the amplifier as a whole can be examined and correction made for improper operating conditions. Last but not least, one can determine accurately the power output with tone input.

From the power output test follows a relatively simple method of determining the efficiency of a modulation transformer.

POWER OUTPUT TEST

To do this, remove all loading from the secondary and connect a resistive load across the primary winding equal to the nominal load required by the modulator valves. Set the output to overload point by means of the CRO and measure the RMS signal voltage across the load. To obtain the power in watts, square the voltage figure and divide by the value of load resistance in ohms. For argument sake, the primary power may work out at 50 watts.

Now remove the load from the primary and connect another resistor across the secondary of such a value that it reflects the same apparent load as before across the primary winding. Set the amplifier to overload point in the secondary circuit, and measure the secondary voltage. Square this figure and divide by the secondary load resistor.

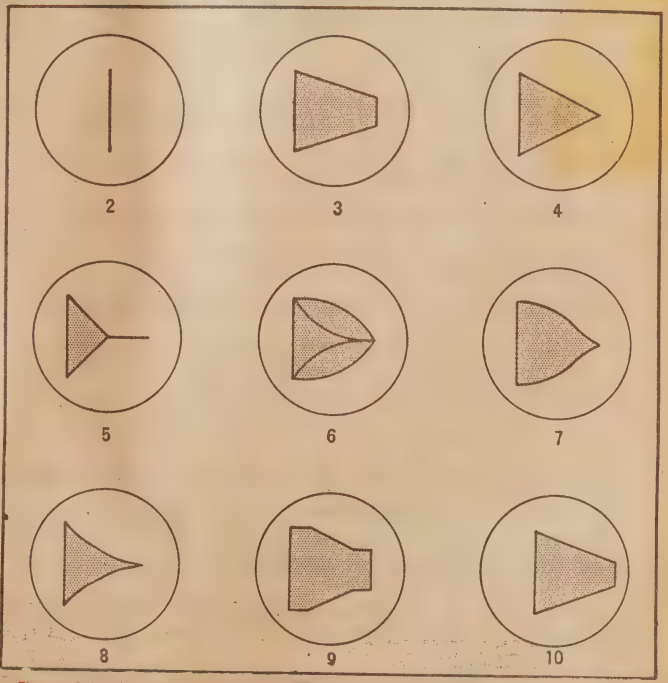
By way of example, the secondary wattage may work out at 40, indicating the modulation transformer is approximately 80 per cent efficient.

Try reducing the secondary load slightly or connecting the same resistor across more of the winding—if it is tapped — and note whether the secondary power increases or decreases. It is sometimes possible in this way to arrive at a figure of load which takes into account the transformer characteristics and the normal variations in valve operating conditions.

The results can be crosschecked later when the complete transmitter is in operation but initial audio tests of load conditions and transformer efficiency are nevertheless very enlightening.

The use of clipper circuits opens up a new avenue for the CRO. It fact, the instrument is essential if a full picture is to be gained of circuit conditions.

Speech signals from the output transformer are applied to the vertical plates and the horizontal sweep adjusted to a fairly low frequency. Careful examination of the operator's speech will then reveal transient



Figures 2-10. A variety of typical trapezoid patterns. The significance of the individual shapes are explained in the text.

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INSTRUMENTS No matter where you live a few pence weekly will obtain your instrument, pay as you play—and sent freight Free. Write for our illustrated catalogue.

Don't think you'd "like to play" and wonder whether you "could"———don't worry about an instrument if you haven't one. SEE HOW EASY IT IS to obtain an instrument and quickly progress at playing. WRITE for this FREE book and catalogue, while available, to—

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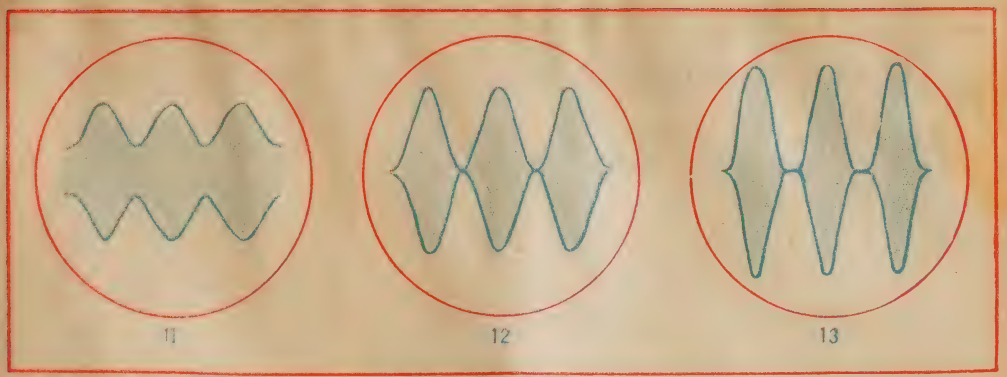
DEPT. 3J, 481 KENT ST. (BOX 4184X, G.P.O., SYDNEY)



Figures 11-13. Envelope patterns showing conditions for less than 100% modulation, 100% modulation and over-modulation.

peaks, which are not essential to intelligibility but which cause instantaneous over-modulation, with resultant splatter.

As the clipping circuit is brought into action, the peaks are flattened off and an ultimate balance can be effected between the degree of clipping and the effect on intelligibility.

The complete technique involves elaborate filters and an adjustment procedure calling for a variable frequency signal source and a CRO. It is covered in detail in various text books.

When the modulator itself has been proved satisfactory, the CRO can be used to determine the performance of the modulated amplifier and to set the modulation level. The tests can take two forms, namely, by inspection of the so-called "trapezoid" pattern and by inspection of the modulated envelope.

R.F. VOLTAGE

For both tests it is necessary to apply a voltage at carrier frequency to the vertical plates. In the normal way the frequency will be far too high for the amplifier to handle, so that direct application must be made to the plates. In most oscillograph designs the plates are made accessible by means of terminals on the front panel, and R. & H. instruments have so far been used successfully at frequencies up to 70 Mc.

The voltage is best picked up by a two or three-turn loop coupled loosely to the final tank. It is fed through a twisted pair to the C.R.O. one lead going to the active deflector plate and the other to the earth return circuit. In general it is wise to bond the instrument and transmitter chassis, although the exact effect is likely to vary.

If sufficient deflection voltage cannot be obtained by a direct connection, an auxiliary parallel tuned circuit can be improvised at the instrument to feed the deflector plate. Vary the coupling to the final tank to give an R.F. deflection line about one-third the height of the screen. Always make sure that the transmitter is properly loaded and correctly tuned up before proceeding to the actual tests.

THE TRAPEZOID

To obtain a trapezoid pattern, it is necessary to pick off a small amount of audio voltage at the hot end of the modulation transformer or choke. It must come from this point and not elsewhere in the modulator. Remember that high d-c and audio potentials are involved and it is well not to place too much reliance on the input circuit of the C.R.O. Provide a high voltage blocking condenser for the d-c and a resistive divider so that only a small proportion of the audio voltage will be across the input potentiometer.

With the transmitter off, only a spot will be visible on the screen When the R.F. circuits go on, the spot will be elongated to a vertical line (figure 2). When tone is applied to the modulator, horizontal deflection will be apparent and, at the same time, the R.F. voltage will be modulated. The result is a trapezoid pattern (figure 3).

REASON FOR SHAPE

The reason for this particular pattern shape is not difficult to understand. When the modulating voltage adds to the R.F. plate supply, the R.F. output voltage is increased. Therefore, in figure 3, the spot moves to the left and the amplitude of the carrier voltage simultaneously increases. Much the same applies where efficiency modulation is used.

On the reverse audio swing, the spot is deflected to the right and the carrier amplitude diminishes, giving a wedge-shaped pattern.

Figure 3 shows an ideal trapezoid pattern for less than 100 per cent modulation. The exact percentage can be calculated by measuring the maximum and minimum heights of the wedge; multiply the difference in length by 100 and divide by the sum of the two dimensions.

Figure 4 shows an ideal trapezoid for 100 per cent modulation, while figure 5 indicates the effect of over-modulation. In this latter case, the audio voltage continues its excursion for an appreciable interval after the carrier amplitude has been reduced to zero. Over-modulation cuts the carrier and produces the familiar "splatter."

In practice, the trapezoids are never as clean as the drawings would indicate, obscurities being introduced by thickness of the spot and slight variations in phase. A considerable phase difference will cause a pattern like figure 6. This is what happens when the audio voltage is derived from other than the secondary of the modulation transformer. If this connection is shown to be in order, the pattern can often be corrected by experimenting with the coupling link to the transmitter, making it shorter, twisting it tighter, earthing one side or, in other cases removing the earth bond. Unpredictable things can happen when there is a lot of stray R.F. around the test bench.

A convex trapezoid, as in figure 7, indicates that some factor is limiting the rise in carrier level on modulation peaks. The usual cause is insufficient drive from the buffer stage However, a low emission final or low emission modulator tube can give the same effect. Yet again, it can be produced by operating a class B modulator from the same supply as the buffer or final, so a reduction in drive or a counter reduction in plate supply accompanies modulation peaks.

REGENERATION

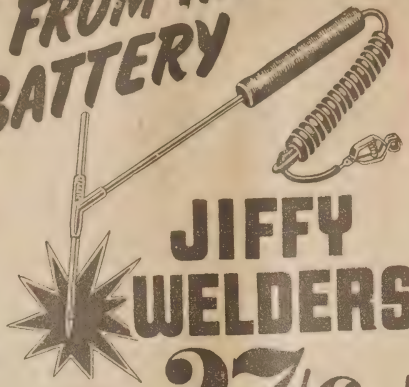
A concave pattern, on the other hand, usually indicates regeneration in the final amplifier, the instability —and output—increasing with plate voltage. The requirement is obvious, although not always so easy to satisfy.

Figure 9 illustrates a condition which can arise with a modulated screen grid or pentode valve, notably when the screen is not adequately modulated. This may be intentional or may be due to an excessively large screen bypass condenser.

If the screen voltage does not reduce to zero, plate current may flow, even with no plate voltage, so that

(Continued on Page 91).

WELD AT HOME FROM ANY CAR BATTERY



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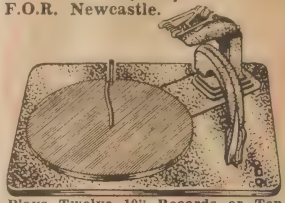

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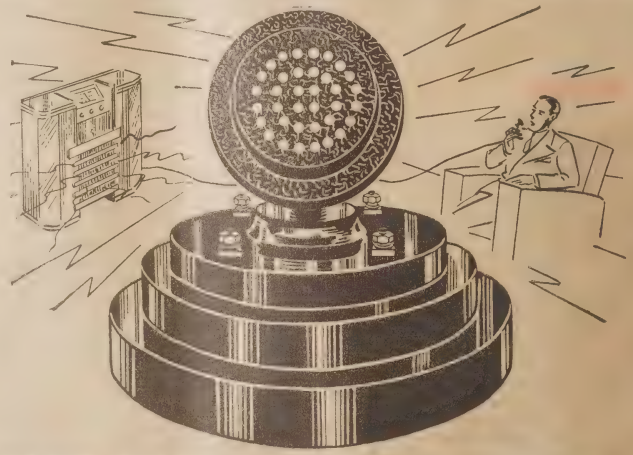

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TRADE REVIEWS AND RELEASES

LATEST BRS RECORDER UNIT CUTS ALL WAYS

Recent improvements have extended immensely the applications of the B.R.S. Recorder unit. It is now possible to cut discs with either inside or outside start and at either 78 or 33 rpm.

OUTWARDLY the appearance of the unit remains unchanged, but the simple substitution of an alternative turntable and the addition of a gear makes possible the extra functions.

Retail price of the basic unit, 78 rpm and inside start, is £45/17/6. To obtain the two-speed feature, it is necessary to purchase an additional turntable at £5/7/6 and a small pulley at 9/6.

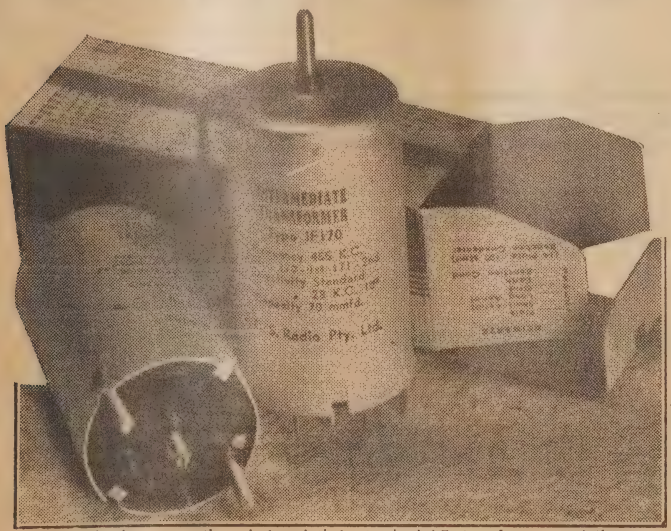
The outside start feature requires the insertion of an additional gear wheel, which is available at 9/3. Thus the retail price for the complete equipment is £52/3/9. For outside start, it is necessary to provide some means of picking up the shaving, either by suction or by collection on a camel hair brush.

Improvements have been made at the same time to other mechanical details, notably the suspension of the recorder arm. The use of ball-bearings for both lateral and vertical movement ensure complete freedom of movement without tendency to looseness.

For further information on BRS recorders, contact the distributor in your capital city. Birnbach Co. Pty. Ltd., 55 York-street, Sydney; A. E. Harrold, 123 Charlotte-street, Brisbane; Byer Industries, Pty. Ltd., 8 Dorcas-street, South Melbourne, SC4, L. S. Wise and Co., 14 Pirie-street, Adelaide.

★ ★ ★

New Line of RCS Transformers



R.C.S. Radio have recently redesigned their standard I.F. transformers and the new units are pictured above. They are housed in a 1⅞in. diameter can, 2½in. high, which carries full details of type number, frequency, position in circuit, tuning capacitance and selectivity standard. The core adjusting screws have been improved and connecting pins made thicker. A special sealing process protects the tuning capacitors from effects of moisture.

TERMINAL STRIP FROM F.N.

LATEST release from F. N. Radio is a screw type terminal strip, as pictured on the right. It is intended for intercom. systems, line equipment and other applications where semi-permanent lead connections have to be made.

The lugs are of heavy gauge and plated ready for soldering. They are riveted into bakelite strip and tapped to receive machined head screws. The strip can be supplied to order, although the standard lines provide for terminal combinations up to six.

In practice, the strip is attached to the side of the equipment and either number or color coded to correspond with the connecting wires. These wires would normally terminate in suitable spade or circular lugs. (F. N. Radio, 265 Military-road, Cremorne, NSW).

"Westectors" Available All States

TO meet the anticipated demand, Amplion (A'sia) Pty. Ltd., are arranging for supplies of "Westectors" to be available in all States.

"Westectors," an abbreviation of "Westinghouse detectors," are diminutive metal rectifiers suitable for use at radio frequencies. Type WX-1 is specially recommended for use in crystal sets, while the "WX-6" with a higher voltage rating, is more suitable for superhet circuits, phone monitors, modulation indicators, &c.

"Westectors" are available with screw terminal connections or with pigtails. In this latter form they are similar on size to a one-third watt resistor. Electrically the two types are identical.

Trade and technical enquiries should be addressed to Amplion (A'sia) Pty. Ltd., 36-40 Parramatta-road, Camperdown, NSW.

★ ★ ★

PLANE AT PORT 5 min.

TIME-ON to time-off the ground at South-west Airways' Monterey, Calif., airport has been cut to 5 min. through efficient planning. And all of the ground work is handled by one man. Mail and passengers are checked in, then information is transmitted to pilot of the incoming plane. Before plane lands, outgoing baggage is on the ramp. Incoming passengers and baggage are unloaded and outgoing baggage is stowed in 1¾min.

AEGIS COILS IN HANDY PACKAGE

A novel approach has been adopted by the Aegis Mfg. Co. in marketing their coils and I.F. transformers. They are available now as a separately packaged kit, branded with the valve combination for which they are best suited.

THE customer merely asks for a coil kit to suit a particular type of receiver, and he is supplied with a carton containing, the coils, IF transformers and a padder condenser. The kit is clearly branded and there is, therefore no chance of confusion or poor results due to the combination of unsuitable components.

As a further aid to the constructor, each carton contains a specimen circuit of a type suitable for use with the particular kit.

The packaged coil kits are available through Aegis distributors in all States. The components will, of course, continue to be available singly, as required.

"S" METER CIRCUITS FOR AMATEURS

(Continued from Page 46)

ed, or the movement from some RF ammeters, which have a sensitivity of about 3 milliamps full scale. Actually, with these more sensitive movements, the meter shunt can be adjusted so that an "S9" signal swings the pointer over to about .9 of full-scale deflection, leaving the remaining portion of the scale for the "S9-plus" signals.

Not all receivers incorporate a back-bias circuit, but sufficient voltage for the purpose can be picked up simply by inserting a 50 ohm resistor in the high tension centre-tap return, giving from 4 to 5 volts drop a typical case. The potentiometer allows an exact adjustment of the bucking current, the limiting resistor preventing an excess current from flowing through the meter if the potentiometer is inadvertently turned to zero ohms. If a greater back-bias voltage is already available, it is necessary only to increase the value of the limiting resistor to keep the current through the bucking circuit down to about 10 milliamps.

In practice the circuit can be set up initially using a multimeter on a higher current scale, the 5 milliamp movement being installed only when initial adjustments have been made.

Circuits 1 and 2 are probably the best to use with a 5 or 10 milliamp movement, but, where a 1 milliamp movement is available, an excellent circuit can be arranged, which gives a substantially logarithmic response in a large receiver.

(The "2JU Eleven De Luke," R. & H. for July, 1948)

The AVC voltage is applied to the grid of a separate valve, and a 1 milliamp meter is connected in the cathode return, in series with a fixed and a variable resistor. This latter resistor is adjusted until the meter reads exactly full scale, with no signal input. When an AVC voltage is developed by an incoming signal, it biases the grid of the separate triode, reduces the plate current, and causes the meter to read something less than full-scale deflection.

The "2JU Eleven" was fitted with a commercial "S" meter having a scale directly calibrated in signal units. No signal corresponds to full deflection, S1 corresponds to the 0.9 milliamp mark, S2 the 0.8 milliamp mark, and so on to S9, which corresponds with 0.1 milliamp. Signals which would be referred to as "S9-plus" reduce the plate current to practically zero.

The meter scale is therefore read in reverse, but there is no ambiguity with direct calibration, and the full sweep of the pointer is used to indicate signal strength. The meter scale was substantially logarithmic in the "2JU-Eleven," each additional signal unit representing an increase in signal strength of 6 db.

Entomologists say that ants are among the most intelligent of all Nature's creatures. They are sensitive to changes in temperature and moisture, and exceed the human range of ability to observe soundwaves. They observe cleanliness in caring for the young, nurse the injured, and remove the dead promptly. It is believed that they have a system of communicating with each other, and are able to recognise each individual of a community.

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REFLECTOR GUNSIGHTS

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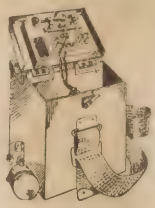
The Lot £3/14/-

Free on Rail Sydney.

Please state your nearest attended Railway Station.



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Brand new RAINCOAT, Army anti-gas; 1 brand new sou'wester; 1 pair brand new waterproof Gauntlets.

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Ex-Army, BRAND NEW. 24oz. each **5/11**

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Ex-Navy, Brand New, original price 8/6. These are super quality. Out they go. EACH .. **3/6**

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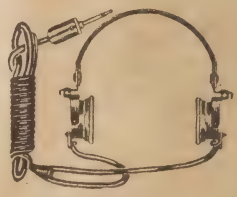

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Brand new, S.T.C. and Stromberg-Carlson. We have just made another purchase of these brand new 'phones, complete with cord and plug, and we are now able to sell them at the ridiculously low figure — 130 ohms impedance **9/6**

Postage, 1/6 extra.

2000 ohms impedance **£1**

Suitable for crystal sets.

PLEASE NOTE: These 'phones are brand new, ex-Army, and not military rejects.

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Brand new American Stirrup Pumps, original cost 27/6. These are in perfect condition. Out they go, each **5/6**

Complete with 15ft. of hose.

Interstate, 3/6. Postage, NSW, 2/-.

No C.O.D.

DEITCH BROS.

Please note our new address

70 OXFORD ST., SYDNEY

HERE'S YOUR ANSWER, TOM!

(Continued from Page 58)

notice. All we can say, therefore, is that accumulators advertised in the magazine should be satisfactory for the purpose. But avoid batteries which have been in service longer than a few months, and always try to obtain from the supplier or manufacturer figures of load and charging current, as mentioned earlier.

The second part of your question is more in our line. We cannot answer it directly, but we will tell you how to obtain the answer yourself.

All connecting wires between battery and load—be it lamp, radio, or appliance — introduce a certain amount of resistance in the circuit, which reduces the effective voltage. The trouble is aggravated by (1) lengthy leads, (2) heavy load current, (3) wires too thin, and (4) faulty connections. The idea, therefore, is to locate the batteries as close to the house as possible, make the wiring as direct and heavy as can be managed, and be doubly careful about all connections.

Reference to wire tables will give you a good idea of the voltage drop to be expected from typical wiring. Say the lighting set is installed in an outhouse, 50ft. from the dwelling, and that the connecting wires are 7/23 SWG gauge.

Reference to standard wire tables indicates that 23 SWG wire has a resistance of 17.69 ohms per thousand feet. Therefore, a 7-strand lead of the same wire would have a resistance of about 2.5 ohms per thousand feet. In the above instance, the length of wire involved would be 100 feet (50 each way), making the line resistance equal to about 0.25 ohm.

This resistance would produce a voltage drop of 0.25 volt at 1 amp, 1.0 volt at 4 amps and 2.5 volts at 10 amps. Obviously, a drop of 2.5 volts in a 12-volt system represents variation of 20 per cent, which is excessive. On the other hand, in a 32-volt system it would represent a variation of only 8 per cent—a much more moderate figure.

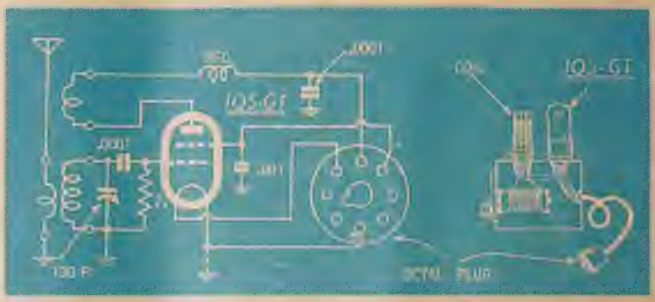
Well, Tom, that is about all the space we can spare for your letter this month, and, in any case, it covers your electrical questions. Hope you have been able to follow us. Anyway, we will try to cover the rest of your letter next month.

A READER BUILT IT!

Gadgets and circuits which we have not actually tried out, but published for the general interest of beginners and experimenters

SHORT-WAVE ADAPTOR REPLACES DETECTOR

The idea of using a short wave adaptor dates back twenty or thirty years but it may have been missed by some of our readers who are in the one or two valve stage. We are reminded again of it by a letter from Mr. W. Wignell, of Flemington, Victoria.



MR. WIGNELL built up the "1Q5-Two" receiver and wanted to try it on the short-wave bands without, however, disturbing the original wiring or broadcast coil. A short-wave adaptor enabled him to do this. The construction is quite simple.

A short-wave tuning condenser and coil-socket were installed on a separate small chassis and wired to an octal socket to suit the 1Q5-GT valve as detector. The circuit was exactly the same as the detector circuit in the original set, but the supply to the filaments, screen and plate was provided by leads terminating in an octal plug.

To use the adaptor the 1Q5-GT detector is removed from its normal position in the set and plugged in to the adaptor. The octal plug from the adaptor is then inserted in the vacant detector socket.

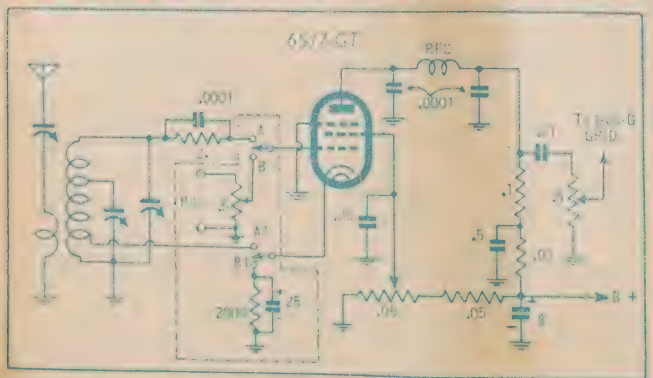
Tracing the circuit through it will be noted that the filament pins in the adaptor connect via the cable and plug to the filament wiring of the detector socket. Whichever filament pin is earthed in the receiver can also be earthed to the chassis of the adaptor. Likewise, the plate and screen circuits make contact with the corresponding circuits in the receiver. It is wise to bypass the screen pin in the adaptor with a .001 mfd mica condenser. The plate circuit will be connected to the reaction winding of the broadcast coil in the main receiver, but this should not matter.

Mr. Wignell built his adaptor on a metal box measuring 3in. x 4in. x 5in., and employed coil data taken from our standard sheet "Coil Details for Small Receivers." (Available through the shilling query service.—Ed.)

In the "1Q5-Two" Receiver, reaction was controlled by means of a potentiometer in the screen circuit, and this same control operates when the short-wave adaptor is in use. Where the original set uses condenser reaction, a separate reaction condenser can be provided in the adaptor, the one in the main receiver having little or no effect on short-waves.

The scheme can be applied to any detector circuit, the exact socket and wiring depending on the type of detector valve used. (From W. Wignell, 63 Waltham-street, Flemington, W1, Victoria.)

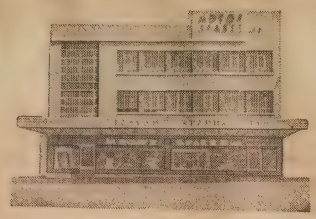
ADDING P.U. TO 2V. RECEIVER



Mr. C. W. Count, a reader from Concord, NSW, has had excellent results from the two-valve transmitter-receiver described in the Shortwave Handbook. He has now added the set and included a pickup switch, so that the receiver doubles as a small record player. The additions to the circuit are indicated by the dotted lines. It is necessary to switch the grid of the valve from the tuned circuit to the pickup volume control, making sure to keep the lead from grid to the switch and thence to the condenser as short as possible. The lead from the switch to the volume control can be any necessary length and shielded. A second pole of the switch changes the cathode lead from the bias circuit to coil tapping. (C. W. Count, 9 High-st., Concord, N.S.W.).

PLASTIC EARDRUMS

A SMALL plastic tube made of korogel, a rubber-like plastic possessing a low melting point, has been used successfully in USA by Audiometric Laboratory to replace eardrums in 500 patients. The artificial eardrum, inserted to touch the stirrup bone, concentrates and funnels sound vibrations inward to permit patient to hear. Tubes vary from ⅛ to almost ½ in. diameter.



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We have large quantities of the parts listed below. Many lines are either British or American manufacture, and were obtained from the British Navy and the United States Air Force. Naturally, the quality is of the highest, and all the parts are brand new, and in perfect condition. We know that the assortments listed will be ideal for both amateur and experimenter. The prices—just a glance through will satisfy even the most canny buyer. As we are one of the largest wholesalers of radio parts in the Commonwealth, we are in a position to supply the trade with all parts at the right price. Why not let us quote you on your future requirements?

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For the benefit of our clients, we have packaged assorted resistors. These are sold as packed, and each lot is slightly different. It will pay you to invest in one or two of these packages.

CARBON. ¼, ½ and 1 watt, values vary between 100 ohms and 10 megohms.
100 assorted. Our price .. 25/-.
50 assorted. Our price .. 15/-.

WIRE WOUND. 5 watt. Values range from 50 to 4000 ohms.
50 assorted. Our price .. 45/-.
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Resistance.	Tapped at. Ohms.	Wattage.	Price. s. d.
25	—		
50	—	20	2 0
100	—	85	5 0
275	15 & 30	40	4 0
300	—	85	5 0
350	variable	85	5 0
500	,,	25	2 6
500	—	25	2 6
850	—	55	4 0
1000	—	20	2 0
2500	—	120	5 0
2500	variable	10	1 6
3000	—	20	2 0
4000	—	18	2 0
5000	—	20	2 0
5000	—	20	2 0
10,000	—	55	4 0
10,000	3000	55	4 0
		55	4 0
12,000	—	20	2 0
20,000	—	55	4 0
24,000	13,000	55	4 0
100,000	—	120	5 0

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ELECTROLYTICS. We have packages of assorted condensers varying in values from 400 mfd. 12 volts to 8 x 8 x 8 mfd. 500 volts working. These are sold as assortments as packed.
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EF50 type Loctal Sockets	2 0
EA50 type Loctal Sockets	6
4 Pin English Moulded Bakelite	6
5 Pin English Moulded Bakelite	6
7 Pin English Moulded Bakelite	1 0
4 Pin Amphenol	10
5 Pin Amphenol	10
6 Pin Amphenol	10
7 Pin Amphenol. Small	10
7 Pin Amphenol. Large	10
Octal Wafer Amphenol and Hy Q	10
Ceramic Sockets, 7 Pin	1 6
Octal Steatite Amphenol Sockets (extremely low loss)	3 6
Miniature Moulded Sockets for IT4, IS5, etc.	1 1
Miniature Moulded Sockets complete with Valve Shield Assembly	2 10

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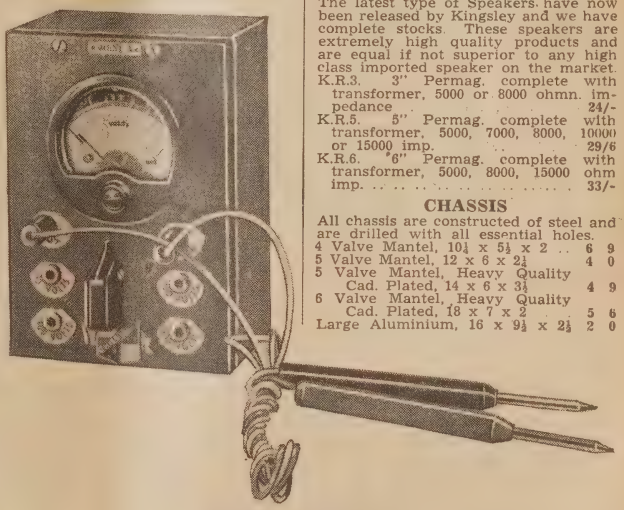
K.R.6. 6" Permag. complete with transformer, 5000, 8000, 15000 ohm imp. 33/-

CHASSIS

All chassis are constructed of steel and are drilled with all essential holes.

4 Valve Mantel, 10¼ x 5½ x 2 ..	6 9
5 Valve Mantel, 12 x 6 x 2½	4 0
5 Valve Mantel, Heavy Quality Cad. Plated, 14 x 6 x 3½	4 9
6 Valve Mantel, Heavy Quality Cad. Plated, 18 x 7 x 2	5 6
Large Aluminium, 16 x 9½ x 2½	2 0



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CHIEFTAIN MULTIMETER. There is no need for you to be without a meter now. This meter has been made up for either the homebuilder or the amateur.
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0—300 ,,
0—600 ,,
Resistance Range 0—100,000 ohms.
Internal resistance of meter 500 ohms.
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So small it fits your pocket.
Price complete with battery and Test Prods. £2 15 0

Back Again And Better Than Ever!

New University PK4X 4-valve Portable Kit Set offers endless pleasure

University's great portable kit set is back again—improved in sensitivity, tone, appearance and ease of construction.

ALL LATEST ADVANCES

The new PK4X Portable is a greatly improved radio and incorporates all the latest technical advances. Even the famous PK3, PK4 and PK5 of the 1940 range are superseded.

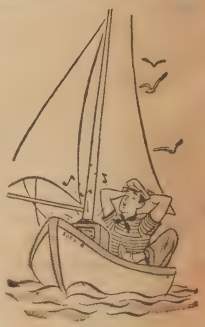
The new PK4X is a four-valve portable kit set employing the latest bantam-type valves and minimax-type batteries. Housed in a genuine leather-covered carrying case, it includes all the parts necessary for the construction of a modern receiver. Carefully engineered and designed the PK4X is simple to assemble with a few ordinary tools. A complete book of instructions specially written for the kit set is included in every package and the easy-to-read and easy-to-follow text is accompanied by clear photographs showing wiring diagrams, circuits and completed appearance.

INSTRUCTIONS ARE SIMPLE, EASY-TO-FOLLOW

The instrument is all assembled for you and wiring is simple and capable of being carried out by anyone who can use a soldering iron.

A clearly marked dial carries all the major stations in Australia and this portable PK4X is suitable for every State.

Get your PK4X now. It is available from all leading distributors throughout the Commonwealth and your satisfaction is guaranteed and backed by a name that is well-known in the radio industry.



TECHNICAL DETAILS

Attractive technical details of this popular kit are a well-designed cabinet covered in solid leather, 5" Alnico type speaker is used, four modern bantam series valves, modern straight line dial, Minimax batteries, special effectively designed loop aerial, provision for external aerial for use in country districts, good tonal quality and excellent sensitivity.

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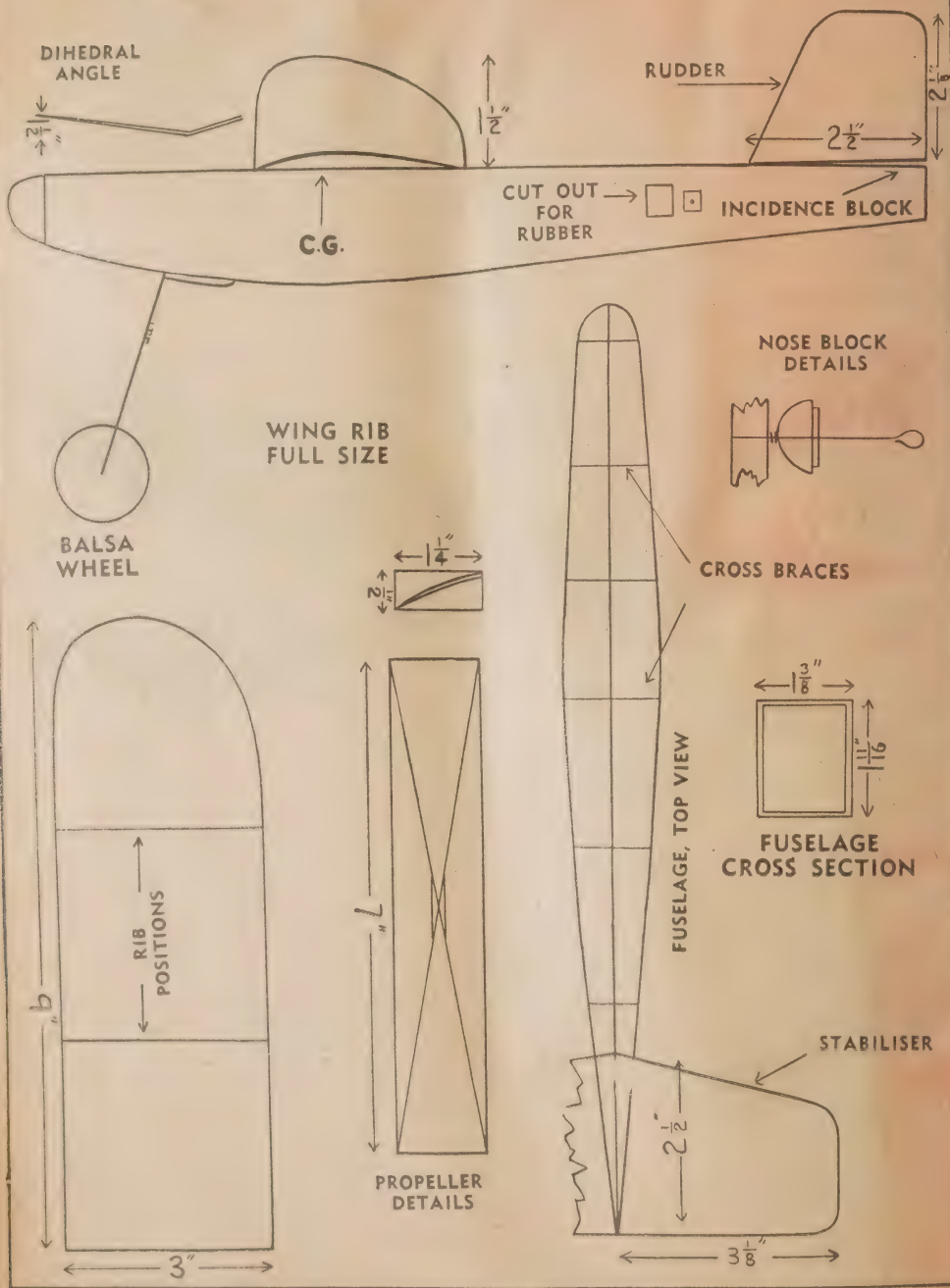
CLIMBING WITH 14,000 HORSEPOWER

ALMOST HANGING ON ITS PROPS, THE US NAVY'S CONSTITUTION climbs steeply on test. The Constitution, largest proven transport aeroplane in the world, has 14,000 horse-power for take-off. Its four Pratt and Whitney Wasp Major engines, each developing 3500 horse-power, turn four-bladed 19-foot propellers. White stripes on the underside of the fuselage of the double-decked Constitution were placed on the aeroplane with gasoline-soluble paint for fuel dumping tests on this flight.

PLANS FOR A SIMPLE FUSELAGE MODEL



YOU CAN BUILD THIS FINE MODEL

Model plane activity seems to be coming back again after a rather dull post-war period. This seems to be a good opportunity to recommence our coverage of practical articles for the model flying man. Our model this month is an easily made all-round job designed by one of our leading enthusiasts.

BEFORE commencing the construction of this cabin model aeroplane it is suggested that you study the plans and photograph carefully so as to get a good idea of the general construction details.

The first step to be taken is to scale the drawing up to full size. This is a comparatively simple job because our plan is drawn half scale. All you have to do is to double each measurement taken from the drawing. I would suggest here that you make your full size drawing on light cardboard. You may then cut out the various parts with a scissor and use them as templates when you start work on your balsa wood.

LIST OF MATERIALS REQUIRED

1 sheet 1-16in x 2in x 36in medium balsa.
1 sheet 1-16in x 3in x 36in light balsa.
1 sheet 1-16in x 3in x 18in light balsa.
1 block 1in x 1in x 1½in medium balsa.
1 block 7in x 1½in x ½in medium balsa.
Some 22 swg piano wire for hooks, propeller shaft and landing gear.
2 cupped washers for propeller bearings.
2 small light wheels, 1 small piece of tin.
2 yards 1-16in x 1-16in model rubber.
1 bottle model aeroplane cement.

Miscellaneous equipment which will be necessary are pins, sand paper, razor blade or fine pointed knife and a bottle of clear lacquer or banana oil.

FUSELAGE CONSTRUCTION

Take your sheet of 1-16in x 2in medium balsa and lightly sandpaper both sides until you have a nice smooth finish. Using your template which is the side view of the fuselage, cut out two identical sides. Lay these two sides by for the time being, and strip up a few pieces of balsa 1-16in x 1-8in wide which are used to space the side pieces apart so as to get the top and bottom plan view of the fuselage. You can now take the two side pieces and place them over your top fuselage shape, pinning them to your drawing board so they are vertical to it. You then glue the small 1-16in x 1-8in balsa strips in place top and bottom.

It is now necessary to cover the top and bottom of your fuselage with sheet balsa. Before so doing it is advisable to lightly sandpaper the top and bottom of the fuselage. Pins will assist here in holding things together until the cement has set properly. When the fuselage has dried thoroughly, lightly sand the whole job and round the corners slightly. It is suggested that you give it a couple of coats of lacquer or banana oil, and when this is dry, sandpaper again.

Your fuselage is finished and we suggest you now make the nose block and undercarriage.

Carefully shape the block to make a good fit in the front of the fuselage.

Cement one of the cupped washers to the front of this block to act as a bearing for the propeller.

The undercarriage is now bent to shape and cemented to the bottom of the fuselage. It is advisable to glue a small plate of balsa over the joint so as to reinforce it because quite an amount of stress is set up at this point particularly when the plane is landing. Possibly the best way to hold the wheels on the axles will be to cement two small pieces of bicycle valve tubing on them.

You should now make a small cut-out in the rear of the fuselage as indicated in the plans to allow you to fit the rubber motor to the motor-retaining peg. This consists of a small piece of wire fitted crosswise in the fuselage to anchor the rear end of the rubber motor. It is advisable to fit the rubber retaining peg through holes punched in small pieces of tin cemented on either side of the rear fuselage. This precaution will stop the tension of the rubber motor when wound from pulling the wire peg through the balsa wood.

TAIL SECTION CONSTRUCTION

Select a piece of 1-16in thick sheet 3in. wide and using the horizontal tailplane template, cut out the outline required. Use your sandpaper to secure a smooth finish and bevel the edges all the way round down to a sharp edge.. Proceed in a like manner with the vertical surface. Keep weight to a minimum consistent with strength.

Having completed each section of the tailplane separately, cement the two together and make sure that you get the rudder at right angles to the stabiliser elevator section. When the cement has dried glue this assembly to the top of the fuselage making sure that the rudder is perfectly straight down the length of the fuselage and that you have the small incidence block in place.

WING CONSTRUCTION

We have also used balsa sheet for the wing. To keep the weight down it will be necessary to use medium to soft balsa for this job. Use your full size cardboard template to cut out the required shape. Form an airfoil section into the sheet by cementing small wooden ribs in place as indicated by the drawing.

The wing is also assembled in the form of a shallow "Vee." This is known as "dihedral angle." The drawing shows the means used to secure this effect and is largely self explanatory. The small balsa blocks fitted under the wing strengthen the centre and also serve as a platform which mounts on top of the fuselage and lines the wing up square with the tail surfaces. Don't forget to smooth things up with that old piece of sandpaper and lacquer or banana oil.

You may now assemble the wing on the fuselage by means of a loop of rubber, use just sufficient tension on this loop to hold wing firmly in place.

Carefully check over the alignment of the plane. See that the tail and rudder are square with one another, that the fuselage and wing line up correctly, and that there are no twists or warps in any of the lifting surfaces. Correct any faults which may be evident and remove warps by steaming and twisting the faulty part back into alignment.

CARVING THE PROPELLER

First we take our block and draw diagonals across the face of it. At the intersection of these diagonal lines drill a hole at right angles to the face of the block. This hole will accommodate the propeller shaft. Remove all the timber as indicated by the shaded part of the drawing. This leaves the blank from which we cut the propeller itself.

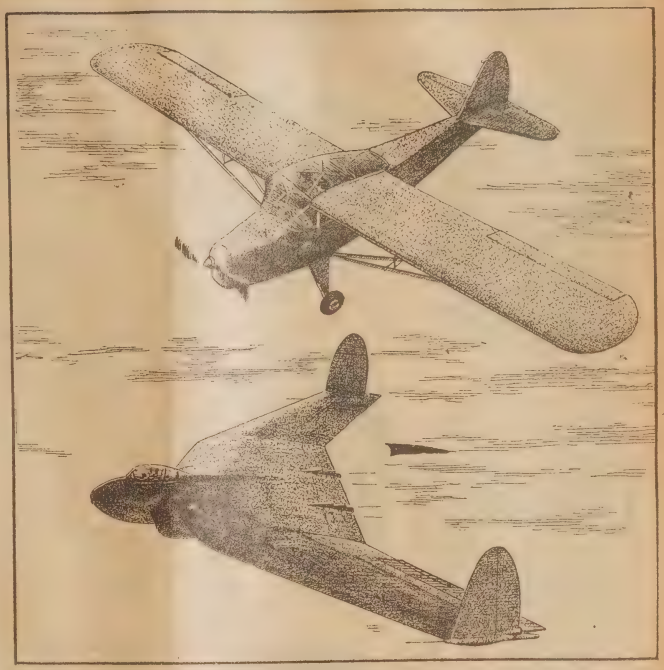
This is done by checking on the end view of the block and removing the timber once again from the shaded portion. This leaves us with the screw-shaped blades, which are nicely sanded and rounded at the tips. This propeller must be bal-

(Continued on Page 89)

by *Jack Finneran*

FAST FLYING—AND NOT SO FAST

Two up-to-the-minute British machines of widely divergent types demonstrate the versatility of aircraft. Described by Sir Ben Lockspeiser, chief designer of Britain's Ministry of Supply, as heralding "a radical departure in the future design of military and civil aircraft," the Armstrong Whitworth AW-52 has been undergoing tests in Britain.



THE AW-52 is one of the interesting "Flying Wing" types that have been developed. It is powered by two Rolls-Royce Nene jet engines.

Following the first successful demonstration flight by this aircraft in December last, experts predicted the use of British "flying wing" planes as long-range night transports, mail carriers or express freighters. The one objection that could be raised to large all-wing aircraft was the absence of view for passengers.

The chief designer of Armstrong Whitworth Aircraft Ltd., Mr. J. Lloyd, said that the all-wing aircraft, with its reduced "drag" and structure weight, indicated the obvious direction of development in high-speed economical air transport.

In flight, the AW-52 belies its unwieldy appearance on the ground. The pilot described it as easy to handle. It needs only a short take-off and can climb rapidly.

500 M.P.H., SPEED

Weighing 33,000lb, the machine has a top speed of approximately 500 miles an hour.

The swept-back wings are boomerang-shaped, with the pilot's nacelle placed well forward. On each wing tip is a fin and rudder. The jet nozzles are located close together in the trailing edge of the wing. Air intakes for the engines are in the wing roots.

A tricycle-type fully retractable undercarriage is fitted.

The aircraft is sketched in flight above (lower left).

The Auster "Autocrat" J/5 (upper right) is the civil version of the artillery observation plane that won renown for its reliability in World War II.—the British version of the American Taylor craft Model D.

A braced high-winged monoplane of welded steel-tube construction, the Autocrat is a three-seat runabout that will doubtless gain steadily in popularity in Australia.

The plane is fitted with a DH Gipsy Major in-line four-cylinder, air-cooled engine of 130 horsepower. The undercarriage is non-retractable.

SHORT RUN

Cruising speed of the Autocrat is over 100 miles an hour, and landing speed is 32 miles an hour and even lower. The plane can land and take-off in less than 100 yards. A roadway or open meadow is sufficient, so that the plane can operate from outback towns or stations without prepared runways.

Range of the plane is 400 miles, with petrol consumption below six gallons an hour.

Ample baggage space is provided, and the cabin gives an impression of spaciousness with its transparent roof.

The plane is now on the market in Australia, the price (including tax) being just over £2000.

COAXIAL HELICOPTER DESIGN GIVES LOW VIBRATION LEVEL

LOW vibration level, greater useful load, and improved stability are incorporated in Bendix Helicopter Co.'s two coaxial contra-rotating helicopters—a single-seater and a five-place craft. The single seater has a 25ft. rotor dia. and is powered by a 92 hp engine. Vertical rotor displacement is 2 1-3 ft. The five-place ship has a 48ft. rotor dia.; rotor displacement is 4½ft. Pratt and Whitney 450 hp engine is displaced 14 degrees from vertical axis.

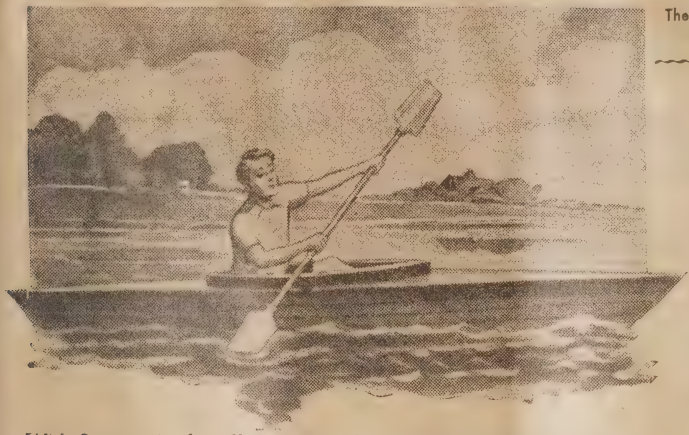
Coaxial contra-rotating rotors result in increased lift. Flight tests also show a gain in thrust over a single rotor averaging 6% from aerodynamic advantages alone. Absence of tail rotor saves about 8% in power available for lift. The company estimates that for each per cent gained in lift, a gain of 3-5% in useful load is realised.

Upper and lower rotor parts are 90% interchangeable. Blades are laminated birch spar to about 30% chord and a plywood covering. Leading edge is bonded stainless steel.

Is Vertical Fin Necessary?

NATIONAL Advisory Committee for Aviation engineers believe that elimination of the vertical fin is possible; tests are being conducted toward that end. Elimination would reduce plane drag, reduce problem of control-surface balancing and stick force, and eliminate undesirable force variation with surface direction. It may also answer the question of control problems at supersonic speeds.

BUILDING A 12 FT. ALL WOOD CANOE



The finished job is buoyant and can move along at a fast clip.

With Summer in the offing, many will be thinking about holidays and waterways. This wooden canoe is well within the capabilities of many woodworkers, and should give them many ideas of how to go about the job of constructing modest pleasure craft.

THIS canoe has been designed for speed, extra buoyancy and grace in shape. It is made entirely from wood, such as deal. This helps to keep the craft light in weight and, despite the softness of deal timber, it is strong—much stronger than a canvas-covered canoe.

It has a large water-tight compartment at the bow and three smaller water-tight compartments aft. Thus, in the event of a capsize, the canoe will not sink should it become flooded with water. In any case, every canoeist should be a person who can swim, particularly if fond of "coasting" around a seaside resort or crossing large inland lakes.

THE BOTTOM SHAPE

To lay the "keel," prepare the bottom piece. This consists of two 10in. wide by ½in. thick shelving boards tongued and grooved together, or alternatively, dowelled together, using ½in. dowelling and marine (waterproof) glue.

It is advisable to adhere the boards together unshaped and, when the glue dries, trim the joint with a smoothing plane and then proceed to mark the curvature shape. This is best done with a long lath of wood which bends easily. The lath is affixed with a nail at one end of the joint, kept out to width at the centre with another nail, then bent to the joint of the board at the other end and nailed. The bent lath serves as a guide for the pencil.

The other side can be marked in the same way, or by means of the waste wood when cut away. Cutting is done, of course, with a bow-saw or keyhole saw. The edges should not be trimmed until the hull-former frames are attached, as these will give the necessary angle to which the bottom edges are planed.

HULL-FORMER FRAMES

The hull-former frames A, B, C, D, E and F (Fig. 1) are cut either from ½in. wood or ⅞in. stuff. The formers B and C are made as frames, being dowelled together, the others being cut out from solid material, rub-jointed together to make up the width or, better still, to ensure strength, they can be dowelled together.

Approximate dimensions are provided. The top centre of each former is notched to take the deck bars. The latter, including the bow and stern posts, must be cut from ⅞in. wood, as shown at Fig. 2. Attach the bow and stern posts to their respective bars, then add the hull-formers. Use glue and 2in. oval nails. A few nails driven into the posts and a single nail at each former will suffice. The top edges of the bars are bevelled to conform with the angle of the formers, so all nail heads should be sunk slightly with a nail punch.

This bevelling is best done when the framing has been fixed to the bottom board. To do so set the work temporarily in position and mark the position of the formers and end posts with a pencil. Make holes between the pencil lines with a bradawl or drill for 1½in. by 6 flathead brass screws, countersinking same on the opposite side, i.e., the under side, of the canoe bottom board.

Having secured the framing temporarily with a few screws, the parts are finally glued and screwed together. If marine glue is not available, use a thick paint, such as old oil paint or tar paint. When driving home the screws, partly fill the holes with putty. Afterwards, conceal the screw heads with putty and level off with glasspaper. Iron screws may be used, but these are liable to rust. The edges of the bottom board are planed to the angle of the formers, and the end posts bevelled.

THE HULL BOARDS

The view at Fig. 3 shows the constructional work clearly, and although the "skeleton" may seem frail, the addition of the hull boards and deck makes everything strong and rigid. Regarding the hull boards, the best material to use is ⅜in. thick matching (tongued-and-grooved sheeting) boards. This stuff is made in the popular width of 3½in., but may also be obtained about 2½in. wide or less.

The latter is more easily "bent" around the hull framework. Sheeting is normally obtainable in lengths up to 14ft. Pick lengths free from loose knots and cracks as much as possible. The first length to be attached has its grooved edge planed away (see Fig. 4). When attaching it, have the end projecting a few inches beyong the bow post; apply thick paint to the formers and use small screws or copper nails which take a good grip. Should the posts themselves not afford a good grip for the nails or screws, strengthening

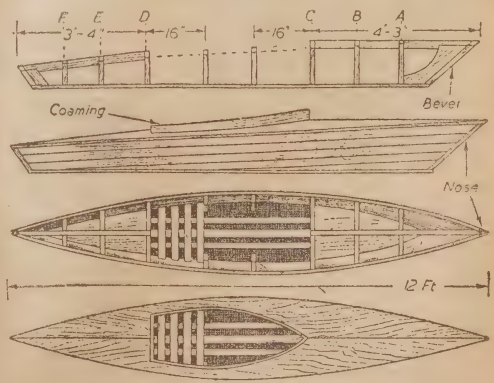


Fig. 1—Side elevation of skeleton framework with plan views.

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24v.	360v. 200MA.	4	0	0
12v.	225v. 50MA.	1	10	0
12v.	350v. 50MA.	1	10	0
12v.	300v. 60MA.	1	10	0
12v.	275v. 110MA.	3	0	0
12v.	300v. 160MA.	4	0	0
12v.	600v. 160MA.	5	0	0
12v.	500v. 160MA.	6	10	0
6v.	500v. 160MA.	6	10	0
6v.	175v. 50MA.	1	10	0
6v.	300v. 160MA.	5	0	0

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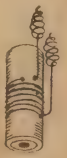

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R.F. COIL with reaction, in aluminium can. Price 9/10. Reinartz Coil, in aluminium can. PRICE, 7/6.

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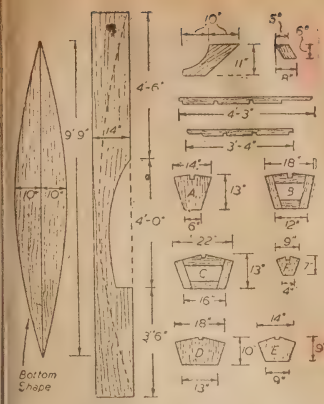


Fig. 2—Bottom and deck shapes with details of end posts and hull formers.

block strips could be added, planing same to conform with the curvature of the work.

Having attached one board, a second length is added. It needs to be bent and forced close prior to securing with nails or screws. There should be a guide line marked on the first hull board, central with the edges of the formers. The tongues and grooves should be coated with paint to keep the joints waterproof.

If you have difficulty in obtaining sheeting, an alternative is to fit "stringers" (laths of wood about 1½in. wide by ½in. thick) at each side of the framework. The stringers are kept about 2in. apart, the topmost being flush with the formers, this also applying to the bottom side, the remainder fitting between.

The spaces between each stringer at the formers are packed with strips of ½in. thick wood. When the stringers have been attached, they are covered with roofing felt. This is carried out after applying paint to the stringers. Before the deck is added, the interior of the canoe is liberally coated with oil paint to make all joints completely waterproof. If desired, red lead paint could be used.

THE DECK SHAPE

Assuming you prefer to use matching board for the hulls, proceed in the manner already described. Owing to the gradual decrease in width from the bow to stern, some lengths become shorter. Allow the ends to project beyond the bottom board for cutting flush later on with a panel saw. The projections at the bow and stern posts are also cut level with the posts and the meeting ends "pointed" with nosing pieces (see top view at Fig .1) which are painted and nailed on.

The deck consists of two half shapes. In order that these lie flat, the top edges of the hull boards and the bow and stern deck bars are bevelled to the angle of the formers with (preferably) a sharp finely-set try-plane or steel jack plane. The deck, of necessity, must be made as separate halves.

One of these halves is shown in Fig. 3. The width of the boards used is about 14in. Since ½in. deal shelving material is never more than 11in. wide, it is essential to dowel two 7in. wide boards together, or use widths which make up 14in.

It is also imperative that the half cockpit shape is cut in each board. This permits the wood to be "twisted" midway so that it lies flat on the tops of the formers. Therefore, having prepared the two boards and cut out the half cockpit shapes, the joining edges are bevelled to meet correctly (see enlarged mid-sectional view—Fig. 5).

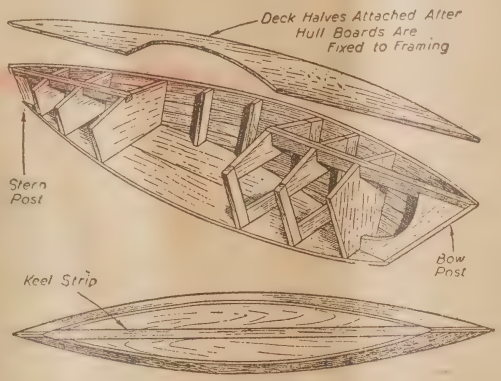


Fig. 3—General constructional view with underside view showing keel.

Lay one board so that its bevelled joining edge is central with the deck bars and nail down temporarily. Attach the opposite board similarly. The curvature of the hull sides is then marked by scribing with a pencil, following which the deck boards are removed and cut to shape.

When this has been carried out, the interior sides of the deck boards are painted, then laid down permanently with oval nails. Use 1½in. long nails and to prevent splitting the wood, and to ensure that the nails drive straight into the edges of the hull boards, make suitable holes with a bradawl. All nail heads are sunk slightly with a punch and concealed with putty. The deck edges are trimmed with a smoothing plane and rounded slightly; this will also apply to the bottom edges. Any gaps or fissures in the hull boards, when shortened, should be filled with putty. Putty sticks better to a painted surface, so it could be used after the woodwork is given its primary coat of paint, which may be red-lead paint.

THE COAMING

Note the two upright "rib" members fitting against the hull boards midway in the cockpit (see Fig. 3). These strips are best fitted prior to attaching the deck boards, being secured with screws. They serve as strengthening battens to the hull boards.

The rim of the cockpit space is surrounded with lengths of ⅜in. matching board, the tongue and groove being removed. The strips should bend easily to correspond with the curvature of the shape, but if not, bending will be facilitated by making a series of 3-16in. deep cross cuts in the strips about 1in. apart. The kerfs "close" against each other as the wood is bent.

Attach the curving strips first, with the fore ends mitred. The back piece goes between. Have the coaming attached with paint and raised-head or ordinary flathead screws. If raised-head screws are used, it will still be necessary to countersink the holes slightly, as such screws have half flat-head and half round-head heads.

SEAT, KEEL AND PADDLES

The seat, as shown in Figs. 1 and 4, is formed by arranging three floor slats together, with the seating laths on top, the latter being about 2in. wide by ¼in., this also applying to the three floor slats. The pieces are merely nailed together, then screwed to the canoe bottom.

To project the underside of the canoe, and also help to give extra strength to the joint, a keel lath (running the length of the craft) should be attached; it can be cut from ½in. wood 3in. wide. The keel is clearly seen at Figs. 1 and 3.

Regarding a suitable paddle, details of a double-bladed type are given in Fig. 4. This may be made from a 1in. thick deal board 8ft. long by 8in. or 9in. wide. It will be observed that the blades are planed to taper at the tips. Drip rings, near

(Continued on Page 83)

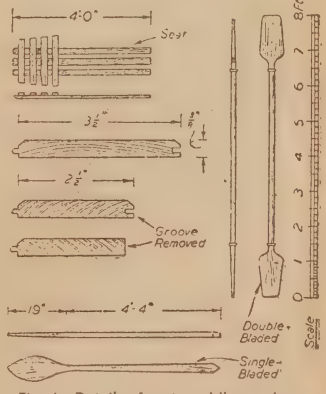


Fig. 4—Details of seat, paddles, and sections of tongued-and-grooved sheeting material used in making the hull.

The 5 BAND KIT FOR YOUR LATEST RIG

TYPE K120 . . . PRICE £3.10.6

consisting of 15 coils:—Aerial, R.F. and Oscillator in the following band.

10 metres	30 MC	to	11 MC
20 Metres	16 MC	to	5.5 MC
40 metres	8 MC	to	3.0 MC
80 metres	4 MC	to	1.5 MC
Broadcast	1600 KC	to	550 KC

This coil kit is suitable for use with a Stromberg H. Type condenser and will give a band spread as above. A smaller gang will give less overlap at each end and amateurs may use our type CV49 double spaced condensers for band spreading in conjunction with the H gang.

A-six bank double sided switch with shorting plate, the 2nd side being used to short circuit all unused coils. IT IS NECESSARY to shield between the Aerial, R.F. and Oscillator sections of switch.
The following padding condensers will be needed.

SEPARATE COILS

COLOR		METRES	FREQUENCY M/C	PADDERS	PRICE
	Nil	B/C Band	.55 to 1.6 MC	R.C.S. Type P21, 5-Plate Adj.	5/6 each
Color dot on END of FORMER.	Green	80	1.5 to 4 MC	R.C.S. Type P21, 5-Plate Adj.	4/6 each
	Red	40	3.0 to 8 MC	0015 fixed condenser	4/6 each
	Yellow	20	5.5 to 16 MC	004 fixed condenser.	4/6 each
	White	15	8.25 to 23 MC	004 fixed condenser.	4/6 each
	Blue	10	11 to 30 MC	004 fixed condenser.	4/6 each

STAND OFF INSULATORS

Color Dot Denotes Grid Lug. Aerial Grid, Black; R.F. Grid, Green; Oscillator Grid, Red.

Mounting screw Type—fitted with 5/32" Brass nut and bolt with solder lug attached. Mounting hole centre 1" x 1-8" moulded from black Polystryene.

1" Type No. A.F.18 1/9 ea.
1½" Type No. A.F.19 2/- ea.
2" Type No. A.F.20 2/3 ea

Pin Jack Type—fitted with Pin Jack to fit standard banana plugs. Mounting hole centres 1" x 1-8" moulded from black Polystryene.

1" Type No. A.F.15 2/- ea.
1½" Type No. A.F. 16 2/3 ea.
2" Type No. A.F.17 2/6 ea.

Iron Cored B.F.O. COILS

The B.F.O. coil with sealed - in Shunt Coil Condenser.

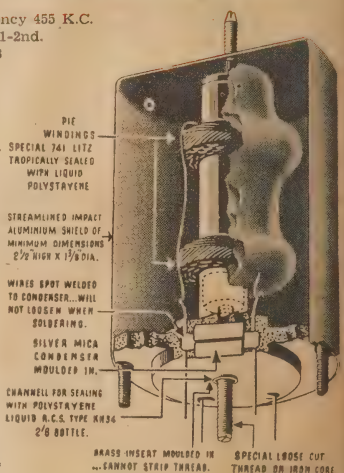
Type H 143 175 K.C.
Type H 144 100 K.C.
Type H 140 455 K.C.
Type H 141 1600 K.C.
Type H 142 1900 K.C.

INTERMEDIATE TRANSFORMERS

Type IF 170 Frequency 455 K.C.
Position 170-1st, 171-2nd.
Selec. Standard 28
K.C. 10-3.
Cap. 70 mmfd.
each 13/-.

Type IF171 Frequency 455 K.C.
Position 170-1st, 171 - 2nd. Selec. Standard 28 K.C. 103.
Cap. 100 mmfd.
Each 13/-.

Type IF174
Low Gain
Each 13/-



New Round Can High Impedance Permability Tuned.

SUPERHET COILS

7/41 Litz Secondary

Extra High Permability Primary

Aerial . . Type No. E356)
R.F. . . . Type No. E357)
Oscillator . . Type No. E358)

7/6 ea. retail

IF YOUR LOCAL RETAILER CANNOT SUPPLY.

If you have been unable to purchase R.C.S. components from your local retailer, write us, and whilst we cannot supply you direct, we will arrange for your retailer to receive suplies immediately or advise you where supplies can be obtained.

LOW LOSS COIL LACQUER KH34, 2/6

A concentrated polystryene lacquer for impregnating all components against humidity, climatic changes, etc. Also invaluable for holding coil turns in place and anchoring ends of coil. An excellent seal for iron core screws and other similar purposes. Every radio engineer and amateur should have a bottle standing by.

COIL FORMERS, 6 PIN PLUG IN

These transparent coil formers are moulded from polystryene powder. They are engraved for frequency and type and indented for color spotting. May also be grooved for space winding. Socket pins are heavily nickel plated.

Type 124 1¼" dia. 3/3
Type 125 1½" dia. 3/5

R.C.S.
RADIO PTY. LTD.

174 CANTERBURY RD., CANTERBURY

BUILDING A 12-FT. ALL-WOOD CANOE

(Continued from Page 81)

he shoulders, are necessary to pre-ent the water running down the haft into the hands; these rings can e formed with a binding of cord. The rings could be placed nearer the niddle of the shaft.

The single-bladed paddle is made rom a deal board 6ft. long by 9in. by in. When cut to shape, and the blade apered, all edges should be smoothly ounded by spokeshaving and glass-aapering. To finish off, apply two r three thin coats of oil paint.

CANOE FINISH

The canoe itself is finished by pplying two thin coats of oil paint, r a hard-gloss enamel paint, over he foundation coat of red lead. Color depends on individual tastes, ut as this is a bright, modern age, he writer suggests bright colors. Light green (on the exterior) and right red (on the interior), with

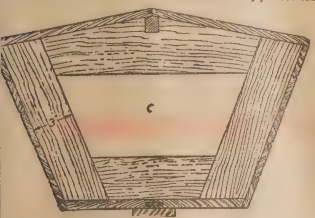


Fig. 5—Mid-sectional view of hull former C.

addles to match, is an attractive ombination. And to make every-ning complete, fit a strong screw-ye to the bow and provide a moor-ng rope, with S-shaped hook at ne end for engaging with the hook-ye. This rope can be stored in the open" compartments. You might lso care to finish your craft with a ame which can be neatly lettered n the bows with black or red paint.

The canoe has a fairly shallow raft so that it can be used on shal-w waters. It will, too, stand up to lot of hard buffeting and accidental ollisions with submerged boulders r rocks. The wise canoeist will, owever, avoid as much harsh treat-ent as possible, remembering that idden bumps cause strain and the reaking of joints in the wood.

In conclusion, it might be added at, in the event of very slight leak-ges of water into the watertight mpartments, due to severe bump-g, it is a good idea to have outlet oles in the decks which are plugged ith a cork. These holes are, of urse, bored over the watertight mpartments only.

USSIA is pushing steel production, now planning to complete 5-year an in 4 years and reaching annual oduction of 25,400,000 tons in 1949. stern mill output rose 56 per cent. ring the war and is steadily up-rd, while southern steel industry operating near prewar capacity. nount going to consumer goods unknown.

SHORT WAVE NOTES BY RAY SIMPSON

VOICE OF AMERICA IN RELAY

VIA NEW B.B.C. STATIONS

A new service seems to have been inaugurated by the BBC in which it relays the well-known "Voice of the United States of America" programmes. Certain of these programmes have been relayed in the past but always on the normal BBC frequencies.

WE have now heard relays of these programmes by the BBC on entirely new frequencies namely, 9.53mc., 9.57mc., and 9.7mc., all of which readers will note are channels assigned to USA stations. The first two are heard at 6.30 am and are possibly on for some time previously. The 9.7mc. channel opens at great strength at 7 am when they announce that it is the BBC London relaying the Voice of the USA with their programme in Russian in the 31, 41, and 49 metre bands. Another transmitter on about 7.295mc. also opens at 7 am, but it is not as good as those on the 31 metre band.

At the time of writing we have not been able to locate the one in the 49 metre band, but readers will probably have found it before these notes are read. It will be interesting to see whether the BBC have call letters allotted to these new outlets or whether there is some working arrangement with the USA to use their channels for these relays.

New SW Station for WA

IN a news item from the ABC we learn that a new short-wave station located in Waneroo in Western Australia was expected to go on the air in August. This is the first we have heard of this station and at the time of writing these notes at the beginning of the month, it has not yet been logged, but quite likely test programmes will be heard before very long on the usual short-wave bands. Readers should watch out for this new transmitter as it will possibly be heard quite well in the Eastern States.

SUMMARY OF EUROPEAN STATIONS

MANY of the European stations are now being heard, especially in the early morning, and the following summary may be of help in logging some of them.

PORTUGAL.—The best heard of these stations is CS2MA on 6.375 mc, which is really fine around 6.30 am, and on a few mornings we have heard another station carrying the same programme on 6.36 mc, but it is not regular and we do not know the call letters as yet. The only other Portuguese station heard at our location is CS2MK on 11.03 mc, which opens at 7 am and can be heard until 9 am, though by that time it is rather weak.

SWITZERLAND. — Always one of the best heard countries from Europe, especially in their programmes for Australia and NZ. Just now HE15 on 11.715 mc and HER5 on 11.865 mc come in very well on Mon., Tue., Thurs., Fri. and Sat. from 5.15 pm till 6.45 pm. Another good transmission is that for North America, which can be heard daily on HER4 9.535 mc, HEU5 11.815 mc and HER6 15.305 mc. The Swiss Curiosity Shop, given at 1 pm, is especially good and in fact the whole programme can be followed from 11.30 am to 1.30 pm. Another Swiss station which is always at good level is HER3 on 6.165 ms from around 6 am and is still at good entertainment level at 7 am. This one is in the European service.

SPAIN. — The only really consistent station from Spain is Radio Nacional de Espana in Madrid, which transmits on 9.369 mc in their European service from 4 am and gives the news in English at 6 am. This station can also be heard at lunch time at good strength in their programme for North America. The only other Spanish stations are on the 7 mc band and around 6.45 am there are quite a number relaying the news in Spanish. Among the best are EA7J Malaga on 7.05 mc, EDV10 Madrid on 7.19 mc, and FET Alicante on 7.94 mc. Another station which we have not personally been able to identify is Radio Falange on 7.95 mc, which some listeners are hearing at 7 am.

FRANCE.—At various times of the day and night the many stations in France can be logged at varying strength. Among the best are 7.28 mc heard in the mornings till 6.45 and also 9.68 mc, which remains on the air until 7.30. In the late afternoons there is an excellent session on 9.55 mc until the station closes at 4.30. Late at night there is also a transmission on 15.24 mc directed to Madagascar, Indo-China and the Near East, and this is also sometimes audible on 17.85 mc, though at our location this latter channel is much weaker than the one in the 19 metre band. In our opinion none of these stations has reached the level of prewar days when Paris was always very good.

VATICAN CITY.—Many listeners are interested in HVJ in the Vatican City, and often inquire as to when this station can be heard. Their present schedule is 5 pm to 5.30 pm on 17.84 mc, 15.12 mc, and 11.74 mc, in English for Australia and New Zealand. The European service in English is heard at midnight on 9.66 mc and 10.095mc, and if you get up early you can also hear an English talk at 4.15 am on 9.66 mc and also on 5.97 mc. On 6.19 mc you can hear an Italian programme at 5.30 am which is also carried on the 5.97 mc channel. Various other services in different languages are heard at other times, and the station can always be identified by announcement "Laudeter Jesus Christus."

GERMANY.—The best heard stations in this country are Munich and Leipzig, the former by means of the American relay stations on 9.54 mc, 11.87 mc, and 15.15 mc, and Leipzig on their channel of 9.73 mc. Munich comes in well till as late as 8 am, while Leipzig is audible in the mornings but at better strength in the afternoons. Radio Munich on 6.16 mc can sometimes be heard at 6.30 am, as also can Radio Frankfurt on 6.19 mc More consistent than either of these, however, is Sudwesfunk Baden-Baden, which operates on 6.32 mc and is sometimes quite loud around 6 am. The Berlin station in the Russian zone is on 6.07 mc but is rarely heard now, though it has a power of 5 kw.

SHORT WAVE notes for the October issue are due on September 4. In the November issue they are due on October 9. Please send them direct to Mr. Ray Simpson, 80 Wilga-st., Concord West, NSW.

THIS MONTH'S VERIFICATIONS

KZCA AUSTRIA.
The Armed Forces Radio Station, KZC in Salzburg is now sending out a very ni verification card which shows a map Austria with a radio tower rising from th town of Salzburg. Above this are th call letters together with circles radiatin around the top of the tower. Verificatio details are shown below while the pow of the short wave outlet on 7.22 mc as 3 watts while that of the broadcast ban channel on 1104 kc is 1000 watts. A nota tion on the bottom of the card states th the call letters were changed from KOF on August 1, 1947.

SINGAPORE, MALAYA.—Radio Malay is now using a new verification card whic is indeed an attractive one. It shows a outline map of India, the Malay Peninsul Sumatra, Java, Borneo and a portion o the Celebes, with the main place name such as Calcutta, Penang, Singapore, Je selton and Batavia. Across the top of th card in large red letters is "Radio Malaya while verification details and a list of the stations is shown at the bottom. Unfo tunately, they do not specifically mentio the station verified which could be any o the 12 listed. We have written to th director of engineering pointing this ou as we know many listeners will be annoye at this omission.

LEOPOLDVILLE, BELGIAN CONGO.
Readers will remember that a few month ago we reported reception of a Belgia Congo station on 19.23 mc and we are no pleased to say that a verification for th one has just turned up. The transmissio we heard was a recording from Rad Congo Belge of the inauguration of th telecomunications system between th Belgian Congo and South Africa. Th speeches were made by the Governo General of the Congo, Mr. Jungers, an the Prime Minister of South Africa, Ge eral Smuts. This is a nice addition to ou African verifications and we only wis the station had stated what the call lette were for this 19.23 mc channel.

AERADIO STATIONS

THROUGH the courtesy of one of ou friends in the RAAF we are able to give a list of the various call letters allo ted to the aeradio stations throughout Au tralia and the NEI: VZAD, Adelaid VZAS, Alice Springs; VZBH, Broken Hi VZBN, Brisbane; VZBO, Bowen; VZB Bundaberg; VZBR, Broome; VZBZ, Hami ton (launch); VZCB, Canberra; VZC Ceduna; VZCH, Coff's Harbor; VZC Cooktown; VZCR, Carnarvon; VZC Cairns; VZCV, Charleville; VZCW, Camo weal; VZCY, Cloncurry; VZDB, Derb VZDN, Darwin; VZDU, Dubbo; VZD Darwin (launch); VZAL, Albany; VZDV Daly Waters; VZFI, Flinders Island; VZF Forrest; VZGM, Mt. Gambier; VZG Geraldton; VZHB, Hobart; VZHC, Ha Creek; VZHK, Holbrook; VZKA, Karumb VZKG, Kalgoorlie; VZKI, King Islan VZKM, Kempsey; VZKN, Katherin VZLA, Lae; VZLH, Lord Howe Islan VZLR, Longreach; VZLT, Launceston VZMA, Mildura; VZME, Mt. Eba; VZM Mackay; VZML, Melbourne; VZMN, Ma galore; VZNI, Nauru; VZNH, Nhill; VZO Oodnadatta; VZOW, Onslow; VZPD, Po Hedland; VZPH, Perth; VZPI, Port Pir VZPY, Port Moresby; VZRB, Rabau VZRK, Rockhampton; VZSD, Sydn (Rose Bay); VZSY, Sydney (Mascot VZSZ, Rose Bay (launch); VZTC, Tenna Creek; VZTV, Townsville; VZTZ, Bowe (launch); VZWG, Wagga; VZWM, Wyn ham.

FLASHES FROM EVERYWHERE

'HINA.—The Station Director of the Cen-ral Broadcasting Station in Nanking has orwarded us advice of two new stations o be operated by his administration and which are carrying out test programmes imultaneously with XGOA on 11.835mc. 'he schedule of these new stations is as ollows: XGRY, 15.25mc, 10.30 pm to 12.15 m, except Sunday; XGRZ, 17.765mc., 10.30 m to 1 pm, except Sunday. They are nxious to have reports on both these new tations. In addition to the above, Radio Australia in their DX session advises hat there is still another one, XGSW on 1.45 mc., but the operating times are not known at present. The address for these tations is 25Sze Tang Hslang, Nanking, China.

Just as we go to press we have further word regarding one of the above stations, XGRZ. It can now be heard at 7 pm, when a news session is given and at the end of the news they give the call, XGOA, but also say they are on 17.765mc., which is, of course, XGRZ. They invite listeners to listen to their next news bulletin which is at 5 pm the following day, so perhaps this is the time that XGRZ comes on the air. Strength is not very good and the quality no better than usual.

KENYA. Readers will possibly remember that for a long time now we have been giving the frequency of VQ7LO Nairobi as 4.855mc., which is the channel they are using, but despite two or three letters to the station they still insisted that they were on 4.885mc. and said they did not use 4.855mc. In a final effort to clear up this matter the writer sent them cuttings from American and New Zealand radio magazines which quoted them as being on 4.855mc. and suggested that the station engineers check their transmitter with a frequency meter or even by an accurately calibrated receiver or by interpolating their station with others on known frequencies. In answer to this letter, we are pleased to say that they now admit they are on 4.855mc. as per the following extract from their letter: "We are, as you say, on 4.855mc., we have three allocations which we use to prevent any jamming."

BELGIAN CONGO. Something of the same sort has been the case with OTC2 in Leopoldville, which over the past few months has been heard on various frequencies between about 9.765mc. to as high as 9.785mc. In reply to our comments on this to the station, they have replied with a very nice letter in which they state: "The programme you heard on February 14th was actually beamed on 9.767mc. which is closely within the range of the 9.775mc. registered by your receiver. We understand that the apparent discrepancy is due to slight wandering and also in some respects, to climatic conditions. However, we are now established on 30.71m., that is 9.767mc. In making our opening announcement, we follow the formula, by beginning with a station identification. That is always followed by our call letters and a mention of the fact that we are the Goodwill Station, and the frequency is given at the end of the programme. We are grateful that you took the trouble to write to us and bring these matters, since it is at times rather difficult to form an overall estimate of the impression made on our listeners by our station literature."

Incidentally, this station is coming in very well just now around 6.30 am.

JAVA. We are indebted to the Swedish Broadcasting Service DX Bulletin for the following information regarding the Semarang stations: Capt. M. J. O. Branse, Territorial Welfare Officer in Central Java and Chief Radio Welfare Section Semarang, tells us that the station is using two transmitters, YDH on 2.5mc. and YDH2 on 11.03mc. Programmes in Dutch are broadcast daily from noon to 1 pm and 9 pm to 1 am and in Indonesian from 2 pm to 3 pm and 7 pm to 9 pm. The transmissions at noon and 7 pm are opened up with the well-known march, "Entry of the Gladiators." Operations for the day are brought to an end at 1 am, firstly in Dutch and then in English. The English announcement runs: "Listeners all over the world are requested to send their reports or QSL cards to Radio Semarang, Java, Indonesia." The station is relaying some programmes from Radio Batavia, which is now broadcasting a programme for Belgium on 15.145mc., 17.63mc. and 19.345mc. from 2.45 am to 3 am."

Another report from Sweden states that a programme in Arabic is heard from an Indonesian station daily from 11 pm to 11.30 pm on both 11.77 and 15.15mc.

Radio Batavia, YDC on 15.15mc. comes in very well on Sunday from 9 pm, when it gives a news bulletin in English followed by some excellent music.

NEW STATION LOGGINGS

Call	KC	Metres	Location	Time Heard
HI4T	5970	50.25	Ciudad Trujillo, Dom. Rep.	9.00 pm
HJEX	6055	49.54	Cali, Colombia	9.35 pm
HI1Z	6110	49.10	Ciudad Trujillo, Dom. Rep.	8.35 pm
VUD3	9620	31.19	New Delhi, India	3.00 am
VP4RD	9625	31.17	Port of Spain, Trinidad	8.00 pm
YDH2	11030	27.20	Semarang, Java	10.00 pm
HVJ	11690	25.66	Vatican City, Vatican	6.30 am
SEAC	11820	25.38	Colombo, Ceylon	2.00 am
LLK	11850	25.32	Oslo, Norway	6.30 am
OZH	15165	19.78	Skamlebak, Denmark	1.30 am
XGRY	15250	19.67	Nanking, China	11.00 pm
XGRZ	17765	16.88	Nanking, China	7.00 pm

NEW STATIONS OF THE MONTH

DOMINICAN REPUBLIC. — Stations in this country are now being heard very well and one of the best just now is HI1Z Ciudad Trujillo on its new channel of 6.11 mc in place of its old outlet of 6.315 mc. This one opens at 8.30 pm at remarkably good strength and can easily be identified as in addition to giving its call letters of HIZ and HI1Z they give the station slogan, "Broadcasting Nacional" and mention the fact that they are a CBS affiliate. After the opening announcement they give a news service with a tapping noise in between each item. Another in this country is HI4T on 5.97 mc, now heard opening at 8.55 pm in parallel with HI2T on 9.727 mc.

DENMARK.—This country is very seldom heard in this country now, though before the war it was quite consistent. We were therefore very pleased to log them once again, and on a new channel, too. While listening to the Test match one early morning we came across OZH operating on a frequency of 15.165 mc around 1.30 am. The programme was an all-musical one, and at 1.45 am an announcement in English was heard saying "You are listening to a broadcast from the Danish short wave station on 15.165 mc." Reports were asked for and the address was given as Danish State Radio, Shortwave Section, Radio House, Copenhagen. We should imagine that a report sent to this station will bring along a verification in due course.

NORWAY. — Another Scandinavian station which has provided a new station is Norway. From Oslo we are now hearing LLK operating on 11.85 mc from around 6 am. While this station is not very loud the programme can be followed and can be checked by comparing it with LLM on 15.175 mc, which carries the same programme and comes in at much better strength. While no English is heard from this station it should easily be recognised by the typical Scandinavian type of speech, which is quite distinct from any other language. The Norwegian people are very prompt in sending their verifications, so write to them when you have logged LLK.

COLOMBIA.—An excellent new station, or we should say an old station on an entirely new frequency, is HJEX in Cali, Colombia. This South American opens with a march at excellent strength around 9.35 pm on 6.055 mc. Opening announcement is in Spanish, of course, but can easily be understood when they give their call letters HJEX short wave and HJER medium wave, Radio Pacifico, Emissora de Cali. Musical numbers are then played till the station fades out after 10 pm, but the call letters are given at least three times in the first half hour, and even if you miss them you cannot mistake the "Radio Pacifico," which is repeated quite often. This station was formerly on 4.865 mc, but was not heard at our location. Ern Moore, of Brisbane, has also heard this station, according to letter just received.

CEYLON. — Radio SEAC, the Forces Broadcasting Station in Colombo, is well known to all listeners, but some may not have noticed that during the Test matches in England they were using a new frequency in the 25 metre band to relay the descriptions from the BBC. This broadcast was carried on 11.82 mc. Actually this was one of the best outlets for the cricket commentary, and unless one listened to the close of play one would naturally have expected it to be GSN, which, of course, uses that channel.

TRINIDAD.—Some months ago we were all hearing VP4RD, "Radio Trinidad," when they were using 9.645 mc in the mornings around 7 am, but they can now be heard at much better strength when they come on the air at 8 pm, but this time using their correct assigned channel of 9.625 mc. At 8.15 pm a lady gives a news session, in English, of course, and this usually concludes around 8.25 pm with cricket and football results. One rather unusual item was the fact that eight pianos had arrived in Trinidad but they had all been sold! Music announcements are the order from 8.30 pm till 9 pm, when the station crosses to the BBC for the news with the announcement that you are listening to Radio Trinidad and the time is 7 am. Listen for this one and you will have no difficulty in finding it, as it is the first station you come to lower in frequency than KZRH, Manila.

INDIA.—The Indian stations are always rather hard to keep track of, as unless one has the station schedule it is impossible to tell what station is being used on any particular frequency. The following outlets may have previously been used, but the writer has not noted them, so they may be new for other listeners as well. The new channels are VUD2 4.96 mc, VUD2 9.63 mc, VUD3 9.62 mc, VUD3 9.67 mc, VUD5 7.29 mc, VUD10 9.63 mc, VUD10 7.29 mc, VUD11 9.63 mc, VUD11 7.21 mc. The only really new frequency is 9.62 mc now being used by VUD3. Apparently any of the VUD transmitters from No. 2 right up to No. 11 can be operated on any frequency as desired.

SUMATRA. Graham Hutchins of Radio Australia received the following schedules of the Sumatra stations from his correspondent in Singapore. Three daily transmissions are broadcast from Bukit Tinggi on announced frequencies of 10.57mc., 7.455mc., and 4.615mc. Their first transmission from 9.30 am till 11. am carries a 15-minute news in English at 10.30 am. The second transmission is from 2.30 pm to 3.30 pm and the third is from 7.30 pm till 1 am. News in English and recorded music for English-speaking listeners is presented from 9.45 pm till 10.15 pm daily. The 10.57mc. outlet has been heard at our location, but strength was very poor.

THE HAM BANDS WITH BILL MOORE

FIRST POST-WAR VK-ZL CONTEST

The outstanding event of the year in amateur circles, without a doubt, is the DX contest. The 1948 DX Test has been arranged by the NZART, the New Zealand National Society in conjunction with the W.I.A. We welcome the ZL's back into the DX test.

THE following are the complete rules for all sections:—

Objects: For the world to contact all VK and ZL call areas and vice versa when:

1201 GMT, October 1, to 1159 GMT. October 3. CW operation.
1201 GMT, October 8, to 1159 GMT, October 10. Phone operation.
1201 GMT, October 15 to 1159 GMT, October 17. CW operation
1201 GMT, October 22, to 1159 GMT October 24. Phone operation.

Duration: (a) For contest purposes, ZL and VK stations will limit their period of operation to any consecutive 24-hour period on each weekend—ie, between the times given above.

(b) Stations in other countries may contact ZL and VK stations for contest purposes at any time during the operating periods as defined above.

Rules:—

1. There shall be three main sections—
(a) Transmitting CW.
(b) Transmitting phone.
(c) Receiving (phone and CW).

2. Contestants may compete in the "open" events (ie, all band) or on one or more individual bands by submitting a log for each individual band

3. The contest is open to all licensed transmitting amateurs and receiving stations in any part of the world No prior entry need be made. Marine mobile and expedition stations are not permitted to enter for the contest.

4. CW will be used for the first and third weekends, and phone for the second and fourth weekends. Stations entering for both the CW and phone sections must submit separate logs for phone and CW. (See Rule 12.)

5. All amateur frequency bands may be used.

6. Only one contact per band per weekend with any one station for contest purposes is permitted.

7. Only one licensed amateur is permitted to operate any one station under the owner's call-sign. Should two or more operators operate any particular station, each will be considered a competitor and must submit a separate log under his own call-sign.

8. Each participant will assign himself a serial number of three figures. When two or more operators work from one station (rule 7), each will assign himself a different serial number. This serial number must remain unaltered for phone and CW contacts.

9. Several numbers to be exchanged during contest QSO's will be as for the ARRL contest—ie, the personal three-figure cypher will be preceded by the signal report, making a six-figure serial for CW and a five-figure serial number for phone.

10. Scoring: Both the VK and ZL station and the station in the remote locality receive one point when a serial number is acknowledged by the station in the remote locality. Each operator adds two points more when a serial number to the VK or ZL station is acknowledged.

11. Multipliers: (a) VK-ZL stations. For each band the multiplier will be the number of countries worked on that band, except that for the USA each call area will be a multiplier. ARRL countries list will be used.

(b) Other stations. For each band the multiplier will be the number of VK-ZL districts worked on that band. These are VK 2, 3, 4, 5, 6, 7, 9; ZL 1, 2, 3, 4.

12. Logs: (a) Logs must show (in this order): Date, time (GMT), band of operation, call of station worked, serial number sent, serial number received, points claimed.

(b) Each new country (or VK-ZL call area) contacted must be underlined in RED ink or pencil.

(c) A separate log must be submitted for each band. For each band a summary must be given, showing (1) list of countries (VK/ZL call areas) worked.

(2) Total number of contacts made on that band. (3) Points claimed for that band.

(d) Summary sheet to show, call-sign of station, name and address of operator, whether entry is for CW or phone, and whether for single band or all-band operation, total points claimed and finally a declaration that all the contest rules have been observed and the regulations for amateur radio in your particular country have been observed and that the log is correct and true to the best of your belief.

13. The judges reserve the right to disqualify any station for (a) consistent tone reports under T8, (b) continuing key-clicks, (c) phone splatter or excessive modulation, (d) off frequency operation.

14.—The Executive Council of the NZART shall be the sole adjudicators, and their ruling will be binding in the case of any dispute.

15. Overseas stations should call CQ VK/ZL, and VK/ZL stations should CQDX Test.

16. Awards: Certificates will be awarded to the station returning the highest score from each participating country (each call area in USA). There will be no world winner. VK and ZL awards, &c., will be announced by the WIA and NZART, respectively.

17. Entries from VK and ZL stations must reach NZART, PO Box 489, Wellington, New Zealand, by November 26, 1948. Overseas logs should reach that address by January 14, 1949. Envelopes must be clearly marked "VK/ZL Contest."

RECEIVING CONTEST

1. The rules for the receiving contest are the same as for the transmitting section, but it is open to members of any short-wave Listeners' Society in the world. No transmitting station is permitted to compete in the receiving contest, too.

2. The contest times and logging of stations, once in each band per weekend, are subject to the same rules as the transmitting contest.

3. To count for points, the call-sign of the station being called and the strength and tone of the calling station, together with the serial number sent by the calling station, must be entered in the log. Three points will be claimed for each such entry in the log.

4. It is not sufficient to log a station calling CQ contest.

5. VK receiving stations cannot log any VK station, and ZL receiving stations cannot log any ZL station, only overseas stations, but VK's may log ZL's and vice versa. Overseas stations will enter only VK and ZL stations heard operating in the contest.

6. The awards for the receiving contest will be similar to those in the transmitting contest.

7. Receiving logs are to be similar to transmitting logs.

All the best in the DX line for October and let us hope conditions are good.

SILENT KEY

AUSTRALIA lost one of her foremost amateurs with the passing of Howard Kingsley Love, VK3KU, on July 29.

VK3KU was well known in the radio industry, and was the first Federal president of the Wireless Institute of Australia. A mover in the formation of the RAAF Wireless Reserve, he was an ardent experimenter, and the results of his efforts were often seen as technical articles in "Amateur Radio." An old-timer passes on and Australian amateur radio is the loser.

AMERICAN PHONE DECISIONS

THE most important decisions, from an international viewpoint, made at the ARRL Board's annual meeting, concerned proposals for the increasing of telephony allocations in the US. The decisions reached were extremely satisfactory for us in Australia, although in no way did it relieve the QRM problem over there.

Of main concern to us was the 14mc proposals to extend the present 14,200 to 14,300 kc allocation to 14,400 kc. The poll which had been taken on telephony proposals showed a 3 to 1 majority in favor of the extension, although only one amateur in six had voted. The result of any extension was acutely obvious to us here in VK, 200 kc. for W. telephony, 50 kc for VE telephony, subtract 75 kc for other telephony stations, and the remaining 75 kc for the world's CW.

The G's, F's and VK's pointed out that any change would ruin the band for both telephony and CW outside the US. The board had a big problem to debate upon, and when the matter went finally to the vote they found themselves divided 50-50, but in their wisdom, seeing that a major and worldwide change could not well be made with any slender majority, they retained the status quo. No proposal will be made to the FCC for any alteration. Decisions of the board are far-reaching, to quote K. B. Warner in a QST editorial: "It is our belief that the ARRL Board of Directors is the best forum in the world for the collection and analysis of the data and the greatly divergent opinions on such a subject as this."

We must congratulate the board on taking such a long-range view, and in these days of international turmoil it is extremely pleasing to see any body worrying about factors that concern others, not in their particular neck of the woods.

Congratulations to the board on a decision that will receive acclaim in all parts of the world, and let us hope it will receive the same support in all parts of the US.

Besides the 14mc band, decisions were reached on the 3.5 and 7 mc. bands. In the first instance, it was decided to extend the telephony allocation to cover 3800 to 4000 kc's.

The board quickly decided against the establishment of any telephony facility in the 7mc band. Both the report of the planning committee and the poll removed any doubt that the W's were against any telephony allocation in the band.

The lopping of 50kc from the 14mc as per Atlantic City will force some of the high frequency end telephony sta-

tions to the low end, but this will be counteracted to some degree by migration to the new 21mc band. We can look forward in the immediate future to no grat changes in the general distribution of stations in our lower frequency bands

W.I.A. NEWS

THE Federal Executive of the WIA report that the department has acceded to a request, that stations operating outside their own State will identify themselves by the use of an oblique stroke and a numeral denoting the State in which they are operating VK2XYZ/3 would be a portable in Victoria.

July meeting of the NSW division saw a good attendance listen to a lecture on "The Interpretation of Ionospheric Predictions," presented by Ross Treharne, VK21Q. Two films were shown, one to illustrate the lecture and the other on atomic energy. In general business, main discussion centred around a proposal for a "gentleman's agreement" to divide the lower frequency amateur bands into telephony and CW sections. As the above subject is perhaps the most contentious in the Ham game and the debate was naturally animated, no decision was reached: the matter was tabled until the next meeting.

Jack Francis, VK20F, will run in conjunction with the monthly bulletin an exchange section.

A.R.R.L. BOARD MEETING

IF we take off enough time and read closely the full minutes of 1948 annual ARRL board meeting, we find many interesting facts. As a matter of habit, we consider ourselves well behind the W's in amateur radio affairs: this may be the case in technical matters, but two points concerning amateur administration listed in the minutes show us to be at least 10 years ahead.

The first concerns a request to to FCC by the ARRL board to withhold all telephony permits below 30mc for 12 months for the new amateurs—a copy of our erstwhile "Probationary Period." The second is a decision to study all possible means of increasing amateur self-policing within our bands—some form of "Advisory Committee" as we have here.

Impressions gained from the minutes show that a minority of the directors desired sweeping changes to be made, especially concerning HQ and its location, and a special committee has been formed to investigate the problem.

THE UHF's

A CONSIDERABLE amount of activity has been taking place on the new 288mc band. Gil Miles, VK2K1, and Jack Davies, VK2YE, set up a record for NSW—70 miles from Mt. Gibraltar, Bowral, to French's Forest. 2K1 had hoped to work from Mt. McAllister, near Goulburn, to Sydney, but between snow and uninviting terrain towards the city the attempt was not made. 2K1 used parallel 6J6's 7 watts input and a three-element horizontal beam. 2YE used PP 7193's to a Yagi beam. Signals both ways at S5. Super-regenerative receivers were used by both stations. VK2ND, of Bankstown, was heard at Bowral by 2K1, and 2YE heard 2ND and 2AGL. Active around Sydney on 288 are 2AGL, 2ND, 2ABZ, 2YE, 2K1 and 2LZ.

An interstate contact on 144mc seems a possibility any time now. VK2MQ, VK4HR and VK4FN during July reported reception of distant stations. Identification was made difficult, due to too rapid signing over between overs. Might be worth while identifying on a number of occasions on this band, during an over.

W6UXN raised his 47th State Mississippi on 50mc and now only requires Vermont for his worked all States certificate.

50mc provided some interest on the weekend, July 17 and 18. On the Saturday, VK2ADT and VK2OC worked VK3GM at 1845 hrs. and on the Sunday VK2OC and VK2ADT contacted VK5GF, VK2NP to VK5GF and VK2XX and VK2YR heard VK5RT, 5QR and 5GF. VK5QR reported hearing VK2KF, all during the early afternoon.

Again, on August 1, 50mc opened to South Australia, VK2ADT contacting VK5GF, 5KG and 5QR. VK2KZ worked VK5QR, 2KZ using a detector and one stage of audio—straight autodyne, not super. regenerating, a fine effort indeed.

Active in Newcastle on 144mc are VK2BZ, 2AGD, 2FP, 2PZ, 2ADT, and they come on at about 1900 hours daily.

DX AND PERSONAL

THAT elusive Tibetan DX station, AC4YN, has turned up on a number of occasions at 2200 hours, 14120/30 kc's. The VK2 DX gang made the most of the opportunity—Reg. is elusive in his operating, also; he replies at odd times, and it seems best to listen for a few minutes after each call you make to him. It was quite enlightening to listen to the antics of some of the W. stations trying to work him.

Conditions on 20MX during the month were poor, but some fine DX came through at times. ZD7AA 14010 1600 hours, ZD2GHK 14025 1730 hours, ZP3AW 14100 2130 hours, CT3AB and 3AA 2000 hours, TA3FAS 14085 T7 1700 hours, and W4DGW/KJ6 1600 hours onwards.

Don't pass up W60DD/VU2 14050: he is at Port Blair in the Andaman Islands, having come down from French India.

W7WVZ offers Nevada to any VK's requiring same for WAS, will QSL by air mail if required, 14020 kc, midnight most evenings.

T18RB, by the judicious use of LM &c., keeps his frequency fairly clear.

The 7MC band is on the improve, telephony permitting, an OA providing a number of VK3's with WAC.

THE SERVICEMAN WHO TELLS

(Continued from Page 35)

said to the lady of the house, who was watching me, 'No wonder it won't work; the licence has expired.' She said, 'Oh!' then, three or four minutes after, 'That wouldn't make any difference, would it?' thoughtfully.

"Here's a wrinkle for those calls when, on having to make an 'on-the-spot' soldering repair to a receiver, and finding the line voltage too low to heat the soldering iron properly.

"I have overcome this by connecting the iron across the outer ends of the power transformer primary. Even with small transformers, this has operated successfully with my 80-watts iron. A simple enough dodge, but you might think it worth publishing."

Thanks, Mr. Johnson, and here's a hint of my own by way of conclusion.

The vibration encountered in some types of gramophone motor can often be reduced considerably by connecting a resistor in series with one power supply lead, to reduce the applied voltage.

VIBRATION IN GRAMOPHONE MOTORS

The resistance naturally decreases the power and starting torque, but not always to the point where the motor runs badly. In any case, some loss in starting torque is small price to pay for a noticeable improvement as regards quiet running.

Try heavy duty resistors of between 100 and 1000 ohms. The most suitable value and the current carrying capacity required will depend on the motor. Some motors will not stand any reduction whatever in the supply voltage.

If no suitable resistors are available an ordinary lamp will serve the same purpose in many cases. Anything from 60 to 100 watts will suffice in many cases.

BUILDING THE UNIT CRYSTAL SET

(Continued from Page 37)

must return to a water-pipe or to a metal plate or pipe in moist ground. Use high resistance earphones for preference—2000 to 4000 ohms. The low resistance 400 ohm types will work well enough, but are less sensitive than good high impedance types.

Experiment with the position of the tappings on the coil. As they are moved from the earthed end, the signal level will increase at the expense of selectivity. It is therefore necessary to use the connections which give the best all-round performance.

In general, it will be found possible to tap the Westector further down the coil than a crystal for the same volume, so that improved selectivity will result. Higher inductance is possible in the coil, which is the reason for the additional number of turns specified in this design.

If your set misses out on stations near the high frequency end of the band, connect the fixed plates of the tuning condenser to the 70 turn tap instead of the end of the coil. In general, it is best to have as many turns in use as possible.

MAKING A START WITH FM

(Continued from Page 41)

channel at a constant level, firstly to reduce the possibility of amplitude-modulated interference from being received, and secondly to keep the signal fed to the second detector circuit at a constant level.

For this reason, AVC is not normally used with FM receivers as the levelling of the carrier is achieved in such a circuit by the limiters.

The audio end of an FM receiver is not primarily different from that of an AM set. If high quality reproduction should be required, it will, of course, be elaborate, although there is no reason why mantel model receivers should not be used. In the latter case, the higher fidelity possible with FM through the use of a wide band width can scarcely be realised, and it is probable that such a set will sound very much like any other, with the possible exception of reduced electrical noise, where it is encountered.

The better quality FM sets, which obviously will be fairly expensive, should use the best possible audio channels, together with the best possible loud-speaker. Present day speakers, although adequate for most AM listening, just won't be good enough for the best that FM will be able to give. Improvements here imply the use of special baffle systems, such as the vented enclosure, and altogether, the proposition of such a set can achieve respectable proportions.

However, here we will leave our introduction to the subject of FM. In next month's issue, we will commence an analysis of circuitry in detail.

MODEL PLANE

(Continued from Page 75)

anced on the shaft so that each blade weighs the same.

If you should have difficulty with the propeller it might be advisable to secure one ready-made from some of the shops catering for model supplies. After satisfying yourself regarding the propeller, fit the shaft and cup washer as indicated in the drawing and loop four to six strands of rubber between the propeller and rear rubber peg.

Balance the model by shifting the wing backwards or forwards on the fuselage until it balances at the point marked CG on the plans. This should be approximately the correct position for the wing. Wind your rubber motor up by turning the propeller to the right until you have approximately one hundred turns stored in it. Launch it gently from you with a slight spearing action. It should sail away from your hand in a smooth climb and then glide gently to a landing. However, if it should climb steeply and then dive, move the wing back slightly and try again. Keep adjusting until you get a smooth even climb and a slow gentle glide back to earth.

As a basis for your adjustments remember that moving the wings forward tends to make it climb, and moving it backwards tends to make it dive. You must aim to secure the happy medium. When you do, you will be agreeably surprised at the performance of this comparatively simple little plane.

Happy landings!

Hints and Kinks for Model Plane Builders

Attention owners of ED diesel engines. You can improve their performance by the use of SAE 70 motor oil instead of the Castor as recommended.

Did you know that the base fuel for GW plug operation should be preferably methanal and castor oil. A little ether or lighter fluid sometimes helps matters along.

You will get better battery performance from a group of pen cells than from larger cells—just a little matter of internal resistance.

High speed spark ignition motors operate best on condensers of .02 to .05 microfarad capacity, voltage rating of 200 is sufficient.

Don't risk that rubber on a bare wire hook. To save it from cutting, use cycle valve rubber tubing.

Don't overdo that pylon fashion on your lightweight rubber job. It might get up windy and then what.

You can overhaul the leading edges of your balsa glider by using the cellulose tape so frequently used these days to hold parcels together.

You can make an excellent quick-drying model cement by dissolving celluloid in acetone. The older and more brittle the celluloid, the tougher the cement.

OFF THE RECORD — NEWS & REVIEWS

The outstanding release this month is undoubtedly the Firebird—a brand new recording conducted by Stravinsky himself. Together with at least two outstanding vocals, and a Schnabel Beethoven, it will give you plenty of fine listening.

By JOHN MOYLE

Firebird Suite (New Augmented Version) (Stravinsky) played by the Philharmonic Symphony Orchestra of New York. Columbia LOX-666-9.

I must confess that I wasn't aware there was an augmented version of this Suite, for which I hope to be forgiven. It does sound different from the Firebirds I have heard in the past, although I'm sure much of this is because the recording is undoubtedly the best I have ever heard. It is recorded well up to the microphone, making the most of the weird and lovely orchestration which mustn't be missed. I can assure you that you have never heard this music so effectively before, at least on records.

I began by thinking the opening section could scarcely be bettered, changed my mind on hearing the Adagio, and then gave up. Frankly, I don't think this orchestra has missed a trick. Maybe the composer's conducting has something to do with it. It certainly should.

The recording is really good. Even on the wide-range equipment, the heaviest and highest passages failed to reveal any serious defect. I looked at the heavy cutting of the Infernal Dance, and shook my head in doubtful anticipation. I needn't have worried. And if there had been a few difficult spots, the sheer exhilaration and weight of the playing would have been ample recompense.

You simply must have these records. They are out of the box.

Concerto No. 2 in B Flat Major (Beethoven) played by Artur Schnabel and the Philharmonic Orchestra conducted by Issy Dobrowner. HMV ED663-7.

This is, of course, an early Beethoven work—Opus 19—it is therefore very different from the more important and grander piano works which are heard so often at concerts. It is, in fact, probably true to say that Australian performances in the last ten years can be counted on the fingers of one hand. It's a pity, because it has all the freshness and easily appreciated beauty of Beethoven's early period, and of the masters who preceded him.

It is, incidentally, an excellent example of Beethoven's habit of avoiding the unnecessary, or, should I say, the irrelevant. For although the master could become verbose on occasions, he rarely if ever leaves us suspended in mid-air as, for instance, Brahms will do many times. Or maybe I should be careful with my comparisons?

Schnabel's Beethoven is almost legendary, and I am one of those who are quite content to leave the work to him with confidence. The music is slighter than we find in the later works, and the net effect for that reason may be less impressive. But if you know Schnabel, and most of you will, you will be prepared for the assurance, and meticulous performance he gives here.

The recording is reasonably good—better with the sapphire point than with steel. This is often the case, as the steels tend to wear somewhat, possibly due to the rather heavy recording. Fibre needle users shouldn't have any trouble.

Brandenburg Concerto No. 3 in G for Strings—Prelude in E from Violin Sonata No. 6 (Bach), played by the Boston Symphony Orchestra conducted by Koussevitsky. HMV ED656-7.

This is one of Bach's best, in my opinion—one of the works I cannot play too often. This recording, however, doesn't impress me as being altogether successful, although it is a bit hard to put a name to it. There is a suspected muddiness about it which doesn't seem to respond to any kind of needle. It lacks a certain essential clarity and weight so often noticed in some of the Philadelphia records, although this effect isn't nearly so noticeable on the second and third sides. It is recorded in rather a dead studio which maybe doesn't help. There is, however, some very fine playing, particularly on side 2, which makes up for a good deal. On the whole, you would be wise to use your own judgment about it.

The Prelude shares popularity with the Brandenburg, and is played with the same force and drive. Marvellous music.

Jesus Suhlaft, Was Soll. Ich Hoffen—Kreuz Und Krone (Bach) sung by Marian Anderson with the RCA Chamber Orchestra. HMV ED782.

The best I have heard from Marian Anderson for a long time. Once or twice she has not been handled kindly in the recording, but I have no fault to find with these on any count. The accompaniment is clean and well balanced—altogether very good. Again, the wide-range equipment handled both sides cleanly throughout, no easy feat. A peerless voice.

Alceste Act I—Divinitee du Styx (Gluck) O Hall of Song (Tannhauser) (Wagner) sung by Helen Traubel with Victor Symphony Orchestra. HMV ED781.

Another outstanding vocal recording of a big, magnificent voice, the dynamic range of which might make stand on end the hair of any recording engineer. However, although the accompaniment is a little light in weight, it is a perfectly clean record, with no sign of blast or break on even the most powerful note. A little more bass, and it would be a very hard one to beat.

Tambourin Chinois—Caprice Vennois (Kreisler) played by Kreslier and the Victor Symphony Orchestra. ED729.

The accompaniment has been newly written by the composer. Both pieces are household words, and played with that intimate and lovely touch which only Kreisler can give. If you like these two old favorites you will go for these most powerfully. The recording is excellent, sympathetic, and nicely balanced. Regretfully I must record a few intonation lapses which, although minor, are

pity. Particularly in these days of impeccable technique. But, then, no one wields a bow quite like this one.

Other Releases This Month

COLUMBIA.

VICTOR SILVESTER AND HIS BALLROOM ORCH.—"The Things I Do For Love" and "The Wishing Waltz." DO.3170.

LOU PREAGER AND HIS ORCHESTRA. "The World Belongs to You, Little Man" and "And Mimi." DO.3171.

VICTOR SILVESTER'S STRINGS FOR DANCING — "Shades of Vienna" and "Fragrant Flowers." DO.3172.

VICTOR SILVESTER AND HIS BALLROOM ORCH.—"Forty-second Street" and "Sometimes" (I Think of Spring). DO.3173.

FRANK SINATRA WITH ORCHESTRA. —"It All Came True" and "Christmas Dreaming." DO.3174.

DINAH SHORE WITH ORCHESTRA—"How Soon" and "Fool That I Am." DO.3176.

LOU PREAGER AND HIS ORCHESTRA —"When The Red, Red, Robin Comes a Bob, Bob, Bobbin' Along" and "Whisper That You Love Me." DO.3177.

BING CROSBY WITH ORCHESTRA—"You're Getting To Be a Habit With Me" and "You've Got Me Cryin' Again." DO.3178.

H.M.V.

JOE LOSS AND HIS ORCHESTRA— . . . . And Mimi" and "A Tree in the Meadow." EA.3728.

TONY MARTIN WITH ORCHESTRA—"The Stanley Steamer" and "That Christmas Feeling" (Perry Como with Orchestra). EA.3729.

JELLY-ROLL MORTON AND HIS RED HOT PAPPERS—Hot Jazz Classic No. 19: "Burnin' The Iceberg" and "Pretty Lil"—Jelly-Roll Morton, Pno.; George Baquet, Clt.; Joe Thomas, Walter Thomas, Paul Barnes, Saxes; Briscoe, "Horsecollar" Draper, Tpts.; Charles Irvis, Tmb.; Barney . . ., Bjo.; "Bass" Hill, Tuba; Alexander Dms. (Recorded 1929). EA.3730.

PHIL IARRIS AND HIS ORCHESTRA —"Poppa Don't Preach To Me" and "Crawdad Song." EA.3731.

VAUGHN MONROE AND HIS ORCH.—"I'm Still Sitting Under the Apple Tree" and "Castanets And Lace." EA.3732.

TOMMY DORSEY AND HIS CLAMBAKE SEVEN—"But I Do Mind If Ya Don't" and "I'll Be There." EA.3733.

BERYL DAVIS WITH ORCHESTRA—"It All Came True" and "What a Fool I've Been." EA.3734.

DUKE ELLINGTON AND HIS ORCH. —"Sherman Shuffle" and "Main Stem." EA.3735.

ROYAL SILVER WEDDING BROADCAST: His Majesty, The King—Broadcast Message to the Nation on April 26, 1948, and Her Majesty, The Queen—Broadcast Message to the Nation on April 26, 1948. REA.3736.

TEX BENEKE WITH THE MILLER ORCHESTRA—"An Old Sombrero" and "Dreamy Lullaby." EA.3738.

VAUGHN MONROE AND HIS ORCH.—"How Soon" and CHARLES SPIVAK AND HIS ORCH.—"Tenderly." EA.3739.

SIDNEY BECHET, with Dr. Henry Levine and His Barefooted Dixieland Philharmonic — "Muskrat Ramble" and "Dicky Wells Blue." EA.3740.

PARLOPHONE

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REGAL-ZONOPHONE

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HARRY KAYE—"Gotta Get Me Somebody To Love" and "A Tree In The Meadow." G.25246.

USING YOUR OSCILLOSCOPE

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the carrier never reaches zero amplitude. Conversely, its upward peak is governed by the mean potential which the screen takes up, so that the rise in carrier amplitude is likewise limited.

Screen modulation alone can give rise to a convex pattern, rather like figure 8 but more angular. In fact, a convex pattern will be obtained with any form of efficiency modulation, where the load and drive conditions are improperly adjusted. Full note should be taken therefore of manufacturers' ratings. Excessive loading or improper drive, leading to a higher mean efficiency, will make it impossible for the efficiency to rise linearly with modulation and with it the carrier amplitude.

NON-LINEAR OUTPUT

A displaced trapezoid, as in figure 10, indicates that the modulator output itself is non-linear, the voltage excursion being greater in one direction than the other.

Actually the displaced trapezoid is the only immediate indication of poor modulator waveform, since a trapezoid pattern fundamentally indicates the relationship between the modulator output and the carrier output, irrespective of audio wave form.

To inspect waveform, it is necessary to swith to internal sweep and to adjust the frequency such that about three wave envelopes are visible on the screen. Figures 11, 12 and 13 indicate respectively modulation percentages something less than 100, exactly 100 per cent and more than 100 per cent. A flattening of the top peaks would indicate modulator overload, while a "feathery" peak would be a sign of instability at a supersonic frequency. The observations on a modulated envelope are more or less parallel with those made on purely audio tones; except that a complete envelope is visible rather than a single line.

COMPARED PATTERNS

Under actual speech conditions—or music for that matter—the modulated envelope pattern is not particularly valuable, since the pattern is so various in its movement and so complicated that the eye cannot take in its full significance. However, the trapezoid retains its triangular form, expanding and contracting with the voice. It is easy to note the overall shape of the pattern and a tell-tale line will appear when over modulation occurs.

A frequent check by this means on modulation depth is a service to yourself and to your fellow amateurs.

ANSWERS TO CORRESPONDENTS

E.J.E. (Holbrook, NSW) sends in a push-pull diode detector circuit for comment, together with his subscription.

A. Many thanks for the subscription, which has been noted. Your detector circuit is in order and would work quite okay. A probable disadvantage in practice is that it would be difficult to control the volume of the set. If you varied the bias of the R.F. valves to control the volume, the distortion of the system as a whole might be higher than is necessary. A diode detector requires a fairly large signal for best operation. If, again, you wished to use an audio volume control a ganged potentiometer would be necessary and this obviously sets a problem of its own. Full-wave diode detectors were used a number of years ago, when twin-diode valves first became available. They were discarded in favor of the half-wave when they were found to have no special advantages to compensate their extra complexity.

??? (Hornsby, NSW) writes on the subject of amplifiers and pickups.

A. Without frequency compensation, crystal pickups usually have a rising bass response which compensates fairly well for the loss in the bass frequencies on the records. Most of the amplifiers we have described have sufficient gain to enable them to be used with magnetic pickups and would still have a reserve even when used with a crystal pickup and compensating network. We have used the 807 in a number of our sets and amplifiers, since it is now available at a special price. It therefore costs little more to build a fairly high-powered amplifier than a small one. Even if the full power output is not required for general use, it is always available should it be required for special occasions. A high fidelity amplifier must have a certain minimum power output to enable it to handle smoothly the full range of amplitudes recorded on modern discs. An amplifier using small triodes with feedback will sound OK, but might easily require as much drive and power supply apparatus as a larger beam power job. The power output of a pair of 6F6-G's as triodes is not very high unless they are used in class AB2 conditions — hardly a high fidelity set up.

R.G.W. (Broadview, SA) renews his subscription and, at the same time, reports success with the vibrator version of "1K5 Four." He has also built a 1.4 volt set with good results. He would now like to see a TRF portable described in Radio & Hobbies.

A. Thanks for the subscription which has been noted. We are very glad to hear of your success with the sets and hope that we have been of assistance with the descriptive data, &c. We cannot promise a TRF portable at the moment, but will keep the idea in mind. However, a circuit for such a set, which used a 3S4 and a pair of 1T4's, was published on the "Reader Built It" page of the January, 1948, issue.

M.C.P. (Waverley, NSW) wishes to use types 1M5-G in the 1K5 FOUR.

A. While the substitution is not ideal from a theoretical point of view, we very much doubt if the difference would be noticed in practice. Neither the socket connections nor the operating voltages would need to be changed.

W.E.L. (Auckland, NZ) suggests that we mark the voltages that should appear at various points on the circuits.

A. Your suggestion is a very good one and worthy of consideration. Actually at various occasions we have shown a table of the main voltage readings although we have never adopted the scheme as standard practice. The internal resistance of the meter has a big effect in many cases so that it would be necessary for the range and sensitivity to be given also.

C.R.W. (Cooran, Qld.) writes in appreciation of the recent beginners' articles in R & H. He would like to obtain the circuit of a one or two valve set suitable for beginners.

A. Many thanks for your kind remarks in regard to R & H. We have a number of circuits which would be suitable for your purpose available through our query service. A circuit, wiring diagram and parts list is available for most designs at a cost of 1/6.

P.R. (St. Kilda, Vic.) suggests that we should describe the triode connected 807 amplifier in conjunction with a unit giving complete and independent control of bass and treble. He is very keen about a simple circuit which was used with a conventional magnetic pickup.

A. Many thanks for your letter and your interest in the particular design. It is often possible to achieve tone compensation directly in the output of conventional pickups because their output voltage is relatively high. However, the characteristics vary to such an extent that it is virtually impossible to arrive at any one circuit which will be suitable for the whole range of pickups. With the more modern low output types it is essential to feed the whole available signal to a preamplifier grid, as any deliberate loss before this point will allow amplifier noise to spoil the final result. Another point is that the degree of amplification necessary is so high that one is likely to run into all kinds of trouble with noise, hum and instability. This, in turn, calls for a clear departure from the conventional technique surrounding domestic amplifiers. You can rest assured that more elaborate circuits will come, but we prefer to allow developments to follow as a matter of course so that readers can become accustomed to the newer techniques.

S.C.W. (Campsie, NSW) writes in with a suggestion that there may be some way in which the apparent over-abundance of volume available from some of the large sets which we have described recently could be reduced for comfortable living-room listening and avoidance of distraction of the attention of neighbors.

A. The direct inference from your letter, S.C.W., is that a certain angle has been misinterpreted or overlooked. Generally speaking, the "tone" or frequency response of an audio amplifier should remain substantially the same for all levels of input. Hence, manipulation of the volume control in order to obtain the desired listening level does not affect the tonal quality. Your analogy with motor car performance does not hold good.

P.J. (East Maroubra, Aust.) tells us of the excellent results he has had with the "Little Jim's Mate" and also forwards another circuit for comment.

A.: The results which you have had, P.J., suggests that the performance of your little set is well up to standard. The circuit which you enclosed is of a super-regenerative type. As such, it is not recommended for general use, particularly on the broadcast band, due to the excessive local interference which it can cause in neighboring receivers.

H.C.C. (Ipswich, Qld.) writes about the success which he has had with a number of the sets and amplifiers which have been described in this magazine.

A.: We can understand your enthusiasm, H.C.C., when we read of the results which you have had. We presume that you have made doubly sure that the alignment is correct on the short-wave band. The use of a dual wave bracket with RF stage would ensure correct tracking over the band. The components which you mention are available in Sydney, though not actually in plentiful supply. Many thanks for your kind remarks concerning the magazine.

J.McG. (Wagga, NSW) says that he has acquired several ex-disposals valves and would like to know something about them.

A. There are far too many of these valves listed for us to undertake the task of keeping track of their characteristics and supplying data for them. Our usual advice is to write to one or other of the valve companies whose interest in such matters is more specialised than ours. The CV6 is a VHF triode with a 6.3 volt heater and fitted with an octal base. Service equivalents are the VR135 and VT232, and the original design is apparently Marconi-Osram. The VR65A is actually the Mazda SP41, and it is a high gain RF pentode somewhat similar in characteristics to the 6AC7. However, it has a British octal base and a heater rating of 4 volts at 0.9 amp. The VR135, as mentioned earlier, is equivalent to the CV6. We have no record of the other type you mentioned, but think that it is a twin diode like the 6H6.

A.W. (Oamaru, NZ) writes to advise about a change of address, and comments favorably on articles in Radio and Hobbies, particularly "The Serviceman Who Tells," and one dealing with the "Checkameter."

A. Your change of address has been noted, and we are pleased to see that you appreciated the article on the Checkameter. One on the subject of vented enclosures was presented in the June issue.

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SELL: All (51 copies) R. & H. May '44 to July '48. Good condition. W. H. Glatz, Angaston, S.A.

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WANTED: Manual for Army No. 19 transceiver. Information, G. W. Thiele, Eudunda, S.A.

WANTED: "R. & H." June '42, April '43 and Sept. '45 required to complete set of R. & H. Spare Mar. '46 and Apl. '47 on hand. K. McGilvery, Eidsvold, Q.